

Exhibit 34

Alice M. Blount, Ph.D.

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IN THE CIRCUIT COURT OF THE CITY OF ST. LOUIS
STATE OF MISSOURI

GAIL LUCILLE INGHAM)	
and ROBERT INGHAM, et)	
al.,)	
)	
Plaintiffs,)	Case Number:
)	1522-CC10417-01
v.)	
)	
JOHNSON & JOHNSON, et)	
al.,)	
)	
Defendants.)	

FRIDAY, APRIL 13, 2018

- - -

Videotaped deposition of Alice M.
Blount, Ph.D., held at the Best Western
Hotel, 5 Best Western Place, Rutland,
Vermont, commencing at 9:23 a.m., on the
above date, before Carrie A. Campbell,
Registered Diplomate Reporter, Certified
Realtime Reporter, Illinois, California &
Texas Certified Shorthand Reporter, Missouri
& Kansas Certified Court Reporter.

- - -

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<p>1 BLITZ, BARDGETT, & DEUTSCH, L.C.</p> <p>2 BY: GLENN A. NORTON, ESQUIRE</p> <p>3 gnorton@bbdlc.com</p> <p>4 120 South Central Avenue, Suite 1500</p> <p>5 St. Louis, Missouri 63105</p> <p>6 (314) 863-1500</p> <p>7 Court-Appointed Special Master</p> <p>8</p> <p>9 ALSO PRESENT:</p> <p>10 Jayne Conroy, Simmons Hanly Conroy</p> <p>11 Ella Fassler, Lanier Law Firm</p> <p>12 Jonathan Cooper, Tucker Ellis</p> <p>13</p> <p>14 VIDEOGRAPHER:</p> <p>15 CHRIS COUGHLIN,</p> <p>16 Golkow Litigation Services</p> <p>17</p> <p>18 ---</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p>	<p>1 8 April 23, 1998 letter from Alice M 35</p> <p>2 Blount to M Raymond Hatcher,</p> <p>3 J&J-0049150</p> <p>4 9 "The Facts About Talc Safety" 40</p> <p>5 printout</p> <p>6 10 Lanier's handwritten demonstrative 42</p> <p>7 notes</p> <p>8 11 "Process Mineralogy IX: 50</p> <p>9 Applications to Mineral</p> <p>10 Beneficiation, Metallurgy, Gold,</p> <p>11 Diamonds, Ceramics, Environment and</p> <p>12 Health"</p> <p>13 12 "Amphibole Content of Cosmetic and 52</p> <p>14 Pharmaceutical Talcs," AM Blount</p> <p>15</p> <p>16 13 April 9, 2018 letter to Richard 54</p> <p>17 Meadow from Richard T Bernardo</p> <p>18 14 Bottle of Johnson & Johnson's baby 58</p> <p>19 powder supplied by Alice M Blount</p> <p>20</p> <p>21 15 E-mail from Jonathan Cooper to 60</p> <p>22 Alice Blount</p> <p>23 16 "Occupational Exposures to 70</p> <p>24 Non-Asbestiform Talc in Vermont,"</p> <p>25 Boudy, et al</p> <p>17 May 21, 1987 McCrone Associates 72</p> <p>letter from Ian M Stewart to</p> <p>Donald M Benniger,</p> <p>J&J-0044868</p> <p>18 November 19, 1975 letter from Gene 93</p> <p>19 R Grieger to Vernon Zeitz,</p> <p>20 J&J-0123236</p> <p>21</p> <p>22 19 Letter about asbestos from Rio 94</p> <p>23 Tinto Minerals</p> <p>24 20 Luzenac America Technical Report, 97</p> <p>25 Julie Pier,</p> <p>IMERYS422289 - IMERYS422290</p> <p>(Exhibits attached to the deposition)</p>

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<p>1 VIDEOGRAPHER: We are now on</p> <p>2 the record.</p> <p>3 My name is Chris Coughlin, and</p> <p>4 I'm a videographer for Golkow</p> <p>5 Litigation Services.</p> <p>6 Today's date is April 13, 2018,</p> <p>7 and the time is 9:23 a.m.</p> <p>8 This video deposition is being</p> <p>9 held in Rutland, Vermont, in the</p> <p>10 matter of Gail Lucille Ingham and</p> <p>11 Robert Ingham, et al., plaintiffs,</p> <p>12 versus Johnson & Johnson, et al.,</p> <p>13 defendants, in the Circuit Court of</p> <p>14 the City of St. Louis, State of</p> <p>15 Missouri, Case Number 1522-CC10417-01.</p> <p>16 The deponent is Alice Blount,</p> <p>17 Ph.D.</p> <p>18 Will counsel please identify</p> <p>19 yourselves and state whom you</p> <p>20 represent.</p> <p>21 MR. LANIER: My name is Mark</p> <p>22 Lanier, and I represent the ladies and</p> <p>23 families affected by the ovarian</p> <p>24 cancer in this trial.</p> <p>25 MR. DUBIN: My name is Morton</p>	<p>1 A. Good morning.</p> <p>2 Q. The jury knows me by now. My</p> <p>3 name is Mark Lanier, and we're playing a</p> <p>4 videotape right now to the jury because</p> <p>5 you're not live at the trial. So this is</p> <p>6 what we call a deposition.</p> <p>7 Thank you for taking time this</p> <p>8 morning. I'm going to ask you some</p> <p>9 questions, and then the other lawyers will</p> <p>10 ask you some questions as well. I'll</p> <p>11 probably come back and ask you a few more,</p> <p>12 and we'll try and move through this with all</p> <p>13 speed.</p> <p>14 Okay?</p> <p>15 A. Okay.</p> <p>16 Q. I've written your name down on</p> <p>17 this sheet, and you can see down at the end,</p> <p>18 Dr. Alice Blount.</p> <p>19 Can you -- make sure I'm</p> <p>20 pronouncing it right. How do you say Blount?</p> <p>21 A. I say Blount, the same as you.</p> <p>22 Q. All right. Very good.</p> <p>23 A. I'm not a southerner.</p> <p>24 Q. You're not a southerner.</p> <p>25 No, you're from Illinois?</p>

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<p style="text-align: right;">Page 10</p> <p>1 A. Yeah, that's not southern. 2 Q. Okay. That's not southern. 3 Fair enough. 4 Dr. Blount, I want to ask you 5 two important questions, and then we're going 6 to dig into some information behind your 7 answers. 8 Okay? 9 A. Uh-huh. 10 Q. The first question is this: 11 Have you tested Johnson & Johnson baby powder 12 for asbestos? 13 A. Yes. 14 Q. And then the important 15 follow-up question: Does Johnson & Johnson 16 baby powder, or did it when you tested it, 17 have asbestos? 18 MR. DUBIN: Object to form. 19 THE WITNESS: Yes. 20 QUESTIONS BY MR. LANIER: 21 Q. Now, because of your answers to 22 those questions, I want to ask you some 23 background information so the jury knows who 24 you are, and I want to ask you a little bit 25 about the asbestos you found.</p>	<p style="text-align: right;">Page 12</p> <p>1 delightful place, though I don't really think 2 we talked about this at all. 3 A. No. 4 Q. All right. Dr. Blount, I want 5 the jury to get the benefit of knowing your 6 background, so let's start out talking about 7 that a little bit. 8 Where did you grow up as a 9 girl? 10 A. I grew up in Carbondale, 11 Illinois. 12 Q. Carbondale, Illinois. That's 13 on the other side of the Mississippi River 14 from St. Louis where we're trying this case. 15 A. Not that far. We used to go 16 into St. Louis all the time. 17 Q. That was the big city for you, 18 maybe. 19 A. Yes, close. 20 Q. Carbondale, Illinois. 21 And you brought with you some 22 papers today, and among those papers was a 23 résumé that you did when you were trying 24 to -- or when you were getting ready for a 25 position or something at Rutgers, I think.</p>
<p style="text-align: right;">Page 11</p> <p>1 You are what we've listed in 2 this trial as a fact witness, so I'm not 3 asking you to give me expert opinions outside 4 of; just what you did and what you understand 5 from your actual actions. 6 Okay? 7 A. Uh-huh. 8 Q. All right. So let's start out 9 with who you are. 10 Now, I've had the benefit -- 11 and we'll get into this in a little more 12 detail later. I've had the benefit of 13 meeting with you I think on about three 14 different times. Three or four; is that 15 right? 16 A. That's about right. 17 Q. I know that on two of three of 18 those times we talked for about 20 or 19 30 minutes about this information over a cup 20 of coffee -- 21 A. Yes. 22 Q. -- at the bakery. 23 A. (Witness nods head.) 24 Q. And then last night we had 25 dinner with your husband, Jack, at a</p>	<p style="text-align: right;">Page 13</p> <p>1 Is that right? 2 A. Yes, Rutgers in Newark, Newark 3 branch of Rutgers. 4 Q. Okay. We'll get to you and 5 Rutgers in a minute. 6 By the way, just for grins, 7 tell the jury where you live now and why 8 we're having to do this by a deposition 9 instead of you just driving in from 10 Carbondale. 11 Where are we today? 12 A. We're in Rutland, Vermont. 13 Q. Rutland, Vermont. 14 And I know you still do some 15 consulting work, but basically -- 16 A. We came up here because I had a 17 job up here. 18 Q. All right. Very good. 19 And then your husband's 20 retired, I think? 21 A. Yes. 22 Q. All right. So let's just grab 23 a couple of things off of your résumé to make 24 sure that we've got everything right. 25 This is a résumé that you did</p>

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<p>1 back when you were at the Department of 2 Geological Sciences at Rutgers in Newark, 3 New Jersey; is that right? 4 A. That's right. 5 Q. And your experience was you had 6 been working with the asbestos problem since 7 1972, specifically with how the FDA proposed 8 an optical method for detecting and 9 quantifying amphiboles and chrysotile in talc 10 used in food and drugs. 11 Is that right? 12 A. So we're talking about 1972 -- 13 Q. Yes, ma'am. 14 A. -- it was -- wasn't that -- 15 that was when the Food and Drug came out with 16 this regulation for the pharmaceutical 17 industry, and my husband was working for the 18 pharmaceutical industry. He was a chemist, 19 and he took -- he was in charge of that 20 department, and they put out this regulation 21 that nobody could understand. 22 Q. Ah. 23 A. And so the person in quality 24 control said, "Dr. Blount's wife is a 25 mineralogist," and so that's why I got</p>	<p>1 Q. And then you went to the 2 University of Wisconsin where you got a 3 master's of science in geology and a Ph.D. in 4 geology in 1970; is that right? 5 A. That's right. 6 Q. Now, you also got -- if I 7 remember the story correct, you also got a 8 husband at the University of Wisconsin? 9 A. Yes, that's right. 10 Q. It's not on your résumé. 11 How did you find your husband 12 when you were looking at rocks? 13 A. Well, he was getting a Ph.D. 14 there, and I needed a computer program that 15 he had. He was very good at writing computer 16 programs. So I went over to the chemistry, 17 and I got this computer program from him, and 18 that's the whole story. 19 Q. And you got the love of your 20 life. 21 You and I were talking about 22 this in doing the math. You-all have been 23 married -- this year makes 50 years you-all 24 have been married? 25 A. Yeah.</p>
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<p>1 involved in 1972, '73, in that region, yeah. 2 Q. Okay. Fantastic. 3 And the jury's got this from 4 other people, but would you just tell us what 5 an amphibole is? 6 Is that -- what is an 7 amphibole? 8 A. It's a mineral. 9 Q. It's a mineral? 10 A. It's a mineral. 11 Q. All right. Now, the jury has 12 heard that asbestos can be an amphibole 13 asbestos or a chrysotile asbestos. 14 A. Uh-huh. 15 Q. Is that -- are we right on 16 that? 17 A. (Witness nods head.) 18 Q. Okay. Now, before we go any 19 further, let's look at the education here. 20 You got your bachelor of 21 science with honors in geology in 1964 at the 22 University of Missouri; is that right? 23 A. That's right. 24 Q. Is that in Columbia, Missouri? 25 A. Uh-huh, yes.</p>	<p>1 Q. That's incredible. 2 All right. Your experience at 3 the time of this résumé back then, you were 4 curator of earth science at the Newark museum 5 and a research associate professor and member 6 of the graduate faculty for the Department of 7 Geological Sciences at Rutgers since 1972. 8 Is that right? 9 A. That's right. 10 Q. And you would actually teach 11 courses in optical mineralogy on a graduate 12 level at Rutgers? 13 A. Right. 14 Q. Can you tell us what optical 15 mineralogy is? 16 A. Well, optical mineralogy is 17 what I would be doing on these samples that 18 I'm looking at to see if there's asbestos. 19 You take a glass slide, and you put your 20 sample on the glass slide, and then you use a 21 microscope so that you can really see what's 22 there. And you can do some tests on -- when 23 they're on the slide, and that makes -- so 24 you can actually identify exactly what it is. 25 (Blount Exhibits 2 and 3 marked</p>

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<p style="text-align: right;">Page 18</p> <p>1 for identification.) 2 QUESTIONS BY MR. LANIER: 3 Q. You brought some pictures, and 4 we'll go into more detail later, but two of 5 the pictures that we'll label -- let's get 6 these labels caught up. We're going to label 7 your résumé as Exhibit Number 1 so the jury 8 can see it. We'll put a number 1 on it. 9 And then we're going to label 10 these pictures as Exhibits Number 2 and 3 so 11 that we've got them as well. 12 And I'll put these up so the 13 jury can see them and the lawyers can see 14 them. 15 But I've put Exhibit 2 -- 16 there's the 2 number. I've put Exhibit 2 up 17 for the jury to see. 18 Is this something you took with 19 an optical microscope? 20 A. You have a picture of the 21 microscope somewhere, I think. 22 Q. Yes, you gave me a picture of 23 the microscope. That's a good point. I 24 should use that. We'll mark it as Exhibit 25 Number 4.</p>	<p style="text-align: right;">Page 20</p> <p>1 A. Yeah, because it's easier to 2 explain. 3 Q. Yes. Yes. 4 (Blount Exhibits 5 and 6 marked 5 for identification.) 6 QUESTIONS BY MR. LANIER: 7 Q. We'll mark the gray background 8 picture as Exhibit Number 5. So let's start 9 with that one. 10 A. Is that the right -- is that 11 the right -- I have an arrow there. Do you 12 have -- can you see the arrow at the side? 13 Q. Yes. Here's the arrow. Does 14 that mean to point it out? 15 A. Yeah, that's the right 16 direction. 17 Q. Okay. Now let me expand it so 18 that we've got a better view. 19 All right. 20 A. And then you got the red one to 21 go with it, too. 22 Q. I'm sorry? 23 A. You got a red one that goes 24 with that, too. 25 Q. Okay. That would be -- this</p>
<p style="text-align: right;">Page 19</p> <p>1 (Blount Exhibit 4 marked for 2 identification.) 3 QUESTIONS BY MR. LANIER: 4 Q. What is Exhibit Number 4? 5 What's this picture we're looking at? 6 A. That's my pictographic 7 microscope that I have at home. It's my 8 microscope, yeah. 9 Q. So this is your microscope you 10 have at home? 11 A. Yeah. 12 Q. An Olympus, looks like a BH2 -- 13 A. Yeah. 14 Q. -- or an EH2? 15 A. I think it's a BH2, yeah, with 16 a lot of accessories on it. 17 Q. Yeah, I started to say, this 18 doesn't look like what we had in high school. 19 A. No. 20 Q. Is this what you used to take 21 this picture that we've got as Exhibit 2? 22 A. Maybe you better show the 23 picture with the gray background. 24 Q. Oh, gray background picture? 25 All right.</p>	<p style="text-align: right;">Page 21</p> <p>1 would be this one. 2 A. Yeah, there should be -- the 3 arrow should be going -- yeah, that's good. 4 Q. Okay. So here, I'll put them 5 both up here together. 6 A. So I -- first I have -- on the 7 right I have a picture through the microscope 8 without any filters or anything, but to tell 9 which direction is what we call the fast 10 direction or the slow direction, you have to 11 put the filter in. So that's what I've done 12 on the left, I've put the filter in. And it 13 makes the background look red, but it gives a 14 yellow tint to that fiber there. 15 Q. All right. So this that my 16 finger's drawing here, I'll put a circle 17 around it. This is what you're calling a 18 fiber; is that right? 19 A. I call it -- yes, I call that a 20 fiber. 21 Q. Okay. And so that's on Exhibit 22 Number 5? 23 A. Uh-huh. 24 Q. On Exhibit Number 6, it looks 25 like the same type thing, but it's all red on</p>

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<p>1 the background.</p> <p>2 A. Yes.</p> <p>3 Q. Is this the one where you --</p> <p>4 A. You put a filter in sort of the</p> <p>5 middle part of the microscope, and it's the</p> <p>6 color of the -- if it's yellow, then we know</p> <p>7 what -- you know, we know it's an asbestos</p> <p>8 fiber. If it was blue, then it wouldn't be.</p> <p>9 So that's why we have these colors here.</p> <p>10 Q. Ah, so that's what tells you</p> <p>11 that that sphere-looking thing is asbestos?</p> <p>12 A. (Witness nods head.)</p> <p>13 Q. Okay.</p> <p>14 A. That's why we put the color in</p> <p>15 there.</p> <p>16 Q. All right. By the way, where</p> <p>17 did you get this asbestos from that's in</p> <p>18 these pictures?</p> <p>19 A. From Johnson & Johnson baby</p> <p>20 powder.</p> <p>21 Q. All right. Now, you actually</p> <p>22 taught the graduate students how to use these</p> <p>23 microscopes and do this work?</p> <p>24 A. Yes, we did -- yes, I taught</p> <p>25 that.</p>	<p>1 Q. And I've also got your paper</p> <p>2 from 1983 that I had kind of an original set</p> <p>3 of, and I got you to sign that one as well,</p> <p>4 didn't I?</p> <p>5 A. You did.</p> <p>6 Q. All right. Well, I'd like to</p> <p>7 make sure that -- so on your background we've</p> <p>8 got your work at Rutgers, where you've got a</p> <p>9 Ph.D. in mineralogy and geology; is that</p> <p>10 right?</p> <p>11 A. Yes.</p> <p>12 Q. I can't spell mineralogy.</p> <p>13 Mineralogy.</p> <p>14 It's something like that. I</p> <p>15 can do geology. Geology.</p> <p>16 Okay. And then you went to</p> <p>17 Rutgers where you did some teaching and</p> <p>18 research, and then you've also done</p> <p>19 consulting for companies, all to -- not all,</p> <p>20 but including to identify asbestos.</p> <p>21 Is this fair?</p> <p>22 A. That's fair.</p> <p>23 Q. All right. Now, I want to</p> <p>24 change to a new subject here, so with that</p> <p>25 being it, you've got your microscope.</p>
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<p>1 Q. Okay. And that's in addition</p> <p>2 to supervising graduate thesis research and</p> <p>3 teaching undergraduate courses as well?</p> <p>4 A. Yes.</p> <p>5 Q. And did you also consult with</p> <p>6 several major industrial minerals companies</p> <p>7 doing this very kind of work --</p> <p>8 A. Yeah.</p> <p>9 Q. -- identifying and counting</p> <p>10 asbestos-type materials in industrial mineral</p> <p>11 products?</p> <p>12 Is that you?</p> <p>13 A. Yes, that's me.</p> <p>14 Q. All right. Well, we've got a</p> <p>15 list here of your publications at the time,</p> <p>16 your references. We'll set that aside for a</p> <p>17 moment, though I did get two of your</p> <p>18 publications from you.</p> <p>19 I got the "Amphibole Content of</p> <p>20 Cosmetic and Pharmaceutical Talcs" you</p> <p>21 published in 1991; is that correct?</p> <p>22 A. Yeah, it looks like it.</p> <p>23 Q. And I made you sign it. I got</p> <p>24 an autographed copy, didn't I?</p> <p>25 A. That's right, you did.</p>	<p>1 Where did you get the asbestos</p> <p>2 from that you've put -- that we've seen here</p> <p>3 in Exhibit 5 and 6?</p> <p>4 You said you got it from the</p> <p>5 Johnson & Johnson baby powder, but where did</p> <p>6 the baby powder come from?</p> <p>7 A. Where the baby powder -- I</p> <p>8 bought it off the shelf, I think in</p> <p>9 New Jersey, but I'm not --</p> <p>10 Q. So you just bought it off the</p> <p>11 shelf?</p> <p>12 A. Yeah.</p> <p>13 Q. Very good.</p> <p>14 You've also got these two</p> <p>15 pictures that I've marked as Exhibit 2 and 3.</p> <p>16 And Exhibit 2, it looks like the -- is this</p> <p>17 sphere-looking thing still the fiber?</p> <p>18 A. Yes.</p> <p>19 Q. Okay. In one picture it's</p> <p>20 yellow, and in the other picture it's blue</p> <p>21 and it's going the opposite direction.</p> <p>22 How is that? Can you explain</p> <p>23 that to me?</p> <p>24 A. Well, it's blue because it's</p> <p>25 oriented in the opposite direction. It will</p>

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<p>1 change color from yellow to blue if you 2 rotate it. So we rotated it. 3 Q. Ah, so that's just you rotating 4 the slide around? 5 A. Uh-huh. 6 Q. And that changes the color? 7 A. Yeah. 8 Q. Why is that? 9 A. Because the light -- the light 10 coming through the sample is polarized, and 11 so it's -- it has a different value as you 12 move it. 13 Q. When I was asking you about 14 this over coffee, you showed me this OSHA 15 paper that -- this OSHA polarized light 16 microscopy of asbestos. 17 A. Uh-huh. 18 Q. And we'll mark this as Exhibit 19 Number 7 so everybody's got an ability to use 20 it and the jury gets to see it, I hope. 21 (Blount Exhibit 7 marked for 22 identification.) 23 QUESTIONS BY MR. LANIER: 24 Q. Now, in that you pointed me to 25 this chart.</p>	<p>1 Q. "Birefringent fibers will 2 change color as the microscope stage is 3 rotated." 4 A. Uh-huh. 5 Q. "Asbestos fibers, except 6 crystallite" -- 7 That's one kind of asbestos, 8 right? 9 A. Uh-huh. 10 Q. -- "will show colors as shown 11 here except under the condition of crossed 12 polars and a first order red compensator." 13 So pointed this way is blue; 14 that way is yellow. 15 I see in Exhibit -- 16 A. Wait a minute. 17 Q. -- 3 blue and yellow; is that 18 right, or do I have it wrong? 19 A. Can I see the -- can I see the 20 white paper? 21 Q. Here, I'm going to give you all 22 of this. 23 A. See the white paper. 24 It says crocidolite, which is 25 shown here. So crocidolite -- oh, let's see.</p>
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<p>1 A. Uh-huh. 2 Q. And this chart says -- 3 A. Uh-huh. But you need to look 4 at this set with this chart. 5 Q. Oh, I need to look at -- 6 A. Yeah, with the polarized, yeah. 7 Q. With these two or with these 8 two? Whoops. We got to do some zoom work 9 here. 10 Oh, I see. I've mixed this up. 11 A. You mixed it up. 12 Q. I need do it this way. Right. 13 So I'm going to put Exhibit 3, 14 the blue one on the left, and Exhibit 2, the 15 yellow one on the right. 16 Now, let's do that and have the 17 jury think of that while I show this. 18 A. Yeah, let me think of that, 19 too. I really did it for the other set that 20 you have. 21 Q. Oh, for the other set. Okay. 22 Well, let me do this. Let me 23 read it first, and then we'll put the set up 24 here. 25 A. Uh-huh.</p>	<p>1 Q. Here we go. 2 A. Okay. So you see here that 3 this goes this way -- these -- I have them 4 marked this way so you can see. And you see 5 that this is yellow now. 6 Q. Uh-huh. I see. I see. 7 A. But they're separate. They're 8 not this way, this way. You have separate 9 views, but you can see here now it's yellow, 10 which means that -- 11 Q. Ah, so that's your flipped 12 view. So it's Exhibit Number 6 with 13 number 5. And if we put Exhibit Number 6 up 14 here, it's going to be right here. I've 15 outlined it in red, but that's hard to see. 16 Let me do black. 17 A. Uh-huh, yeah, that's it. 18 Q. All right. So -- and then I'm 19 going to kind of fold it up just to give the 20 jury a chance to see. 21 Right next to the chart, that 22 yellow that we're looking at is the asbestos? 23 A. Uh-huh. 24 Q. Okay. And you're nodding your 25 head and saying "uh-huh," but she's going to</p>

8 (Pages 26 to 29)

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<p style="text-align: right;">Page 30</p> <p>1 type this up as well. And uh-huhs, even with 2 the great Carrie Campbell, can sometimes read 3 like huh-uhs, so I need to make sure I've got 4 a yes or no out loud, if you don't mind. 5 A. Okay. Yes. 6 Q. All right. So that is -- the 7 yellow like that is the asbestos; is that 8 right? 9 A. That shows us, yes, that -- 10 because of the -- the light goes through at 11 different rates going this way or this way, 12 so that makes a difference when you put this 13 filter in. You can tell the difference 14 between the fast ray and the slow ray. 15 Q. Super. Super. 16 Now, you wrote up papers, and I 17 know in your 1991 paper you actually talked 18 about the fact that there was asbestos in the 19 baby powder. It looks to me like you -- and 20 the jury will have a chance to read this in 21 more detail and see that Sample I, talc 22 Sample I, is actually Johnson & Johnson baby 23 powder. And nobody's fussing that. The 24 company's got those records and -- 25 MR. DUBIN: Object to form.</p> <p style="text-align: right;">Page 31</p> <p>1 QUESTIONS BY MR. LANIER: 2 Q. -- and everything else. So 3 just accept that with me right now. 4 "Percent amphiboles in each 5 aspect ratio group for talc Sample I left and 6 M right compared with tremolite asbestos and 7 tremolite non-asbestiform." 8 So let me ask you as we zoom in 9 on the Johnson & Johnson. Is the asbestos 10 that you found a tremolite asbestos? 11 A. Yes. 12 Q. And you can see this form of 13 it? Is that the dotted line? 14 A. Yes, that's what it -- what 15 the -- what they found out about it. 16 Q. And if we look at your counts 17 in these talcs on an earlier page and we look 18 at that Sample I, which I think the record 19 shows is the Johnson & Johnson baby powder -- 20 MR. DUBIN: Objection. Form. 21 QUESTIONS BY MR. LANIER: 22 Q. -- these particles per 23 milligram, is that how many particles you 24 were finding of the asbestos? 25 A. That's what it's finding on the</p>	<p style="text-align: right;">Page 32</p> <p>1 slides, yeah. 2 Q. Needles and fibers? 3 A. But can we go back just a 4 little bit there? 5 Q. Yes, tell me -- 6 A. The reason that I plot them up 7 like you show there is that it's very 8 difficult sometimes when you look at 9 something to know whether it's a needle or a 10 fiber or, you know, it's something that you 11 have to count or not. 12 But if you have a population -- 13 and we know what the population is because 14 you just marked it. And when I go through 15 and mine line up with that population, then I 16 know it's asbestos. But if it doesn't line 17 up -- it might line up over here with the 18 other side, and then I would know it's not 19 asbestos. 20 Q. Ah, okay. So the other side, 21 because of the sizes and all, is more 22 nonasbestiform, but this is asbestiform, or 23 asbestos, because you've got this ratio down 24 here that's so big; is that it? 25 A. Uh-huh. That's the way --</p> <p style="text-align: right;">Page 33</p> <p>1 that's -- 2 Q. Okay. 3 A. -- their population. 4 Q. All right. So this is -- this 5 is asbestiform asbestos that you were finding 6 in the Johnson & Johnson baby powder that you 7 pulled off the shelf? 8 A. Uh-huh. 9 Q. And you weren't doing this 10 because anybody was paying you money to do 11 it, or were you getting paid to do it? 12 A. No, I wasn't. 13 Well, I had some students 14 working on some talc projects, I guess, so it 15 may -- you know, I may have bought it then to 16 show the students what it looked like, you 17 know. 18 Q. All right. Part of your 19 teaching? 20 A. Yeah. 21 Q. Okay. Very good. 22 I've got some more questions I 23 can ask you that I want to ask you, but I 24 think at this point I'm going to pause and 25 let the other lawyers go because I'm going to</p>
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9 (Pages 30 to 33)

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<p>1 save these questions and come back with them</p> <p>2 in a little bit.</p> <p>3 So I'm going to pause at this</p> <p>4 point -- no, let me go ahead and ask you a</p> <p>5 couple more. Bluff. Sorry.</p> <p>6 MR. DUBIN: I was going to</p> <p>7 object, but I was waiting.</p> <p>8 MR. LANIER: Bluff.</p> <p>9 QUESTIONS BY MR. LANIER:</p> <p>10 Q. So you live in Vermont and you</p> <p>11 still test things for asbestos; is that</p> <p>12 right? Do you still?</p> <p>13 A. I do -- not much anymore, but a</p> <p>14 lot of what I did was only I had -- I had</p> <p>15 property around the world, and we had to test</p> <p>16 them -- their stuff for asbestos just like we</p> <p>17 had to test here. So we were doing the</p> <p>18 testing for all of North America, South</p> <p>19 America and Pacific Rim.</p> <p>20 And these companies -- the</p> <p>21 plants themselves would send the samples to</p> <p>22 us, and that's -- I spent a lot of time doing</p> <p>23 that.</p> <p>24 Q. All right. I've had a chance</p> <p>25 to look at some representations that Johnson</p>	<p>1 QUESTIONS BY MR. LANIER:</p> <p>2 Q. All right. And then there's</p> <p>3 one other letter that I've found interesting,</p> <p>4 and we'll mark this as Exhibit Number 8. And</p> <p>5 I'm looking specifically at a letter that you</p> <p>6 wrote, Alice M. Blount, Ph.D., mineralogist.</p> <p>7 Is that you?</p> <p>8 A. Uh-huh, that's me.</p> <p>9 Q. And is that your signature?</p> <p>10 A. Yes, that is.</p> <p>11 Q. In fact, you signed your name</p> <p>12 in 1998 just about exactly the same way you</p> <p>13 signed your name for me at the bakery, coffee</p> <p>14 shop in Rutland, Vermont, when I had you</p> <p>15 autograph your article.</p> <p>16 A. Yeah, well...</p> <p>17 Q. That's 20 years. You sign your</p> <p>18 name the same way.</p> <p>19 A. Uh-huh.</p> <p>20 Q. All right. So we've got your</p> <p>21 letter here.</p> <p>22 A. Yeah.</p> <p>23 Q. And you wrote this letter to a</p> <p>24 law firm that did asbestos work, Mehaffy and</p> <p>25 Weber in Beaumont.</p>
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<p>1 & Johnson has made to -- in courts through</p> <p>2 their lawyers, and just recently in</p> <p>3 New Jersey, for example, January 29th of</p> <p>4 1918 -- of 2018. Yeah, real recent. It was</p> <p>5 a century ago.</p> <p>6 January 29th of 2018, the</p> <p>7 Johnson & Johnson lawyer made this</p> <p>8 representation. Said that "cosmetic talc</p> <p>9 locations are not favorable for the</p> <p>10 development of asbestos," and then went on to</p> <p>11 talk about how asbestos needs "hard surfaces</p> <p>12 that are cracked to develop, but talc is the</p> <p>13 softest mineral on earth," so it's in soft</p> <p>14 places.</p> <p>15 Based upon your experience and</p> <p>16 the facts that you've developed, is that</p> <p>17 true, that cosmetic talc locations are not</p> <p>18 favorable for the development of asbestos?</p> <p>19 MR. DUBIN: Objection to form.</p> <p>20 MR. PROST: Object to form.</p> <p>21 THE WITNESS: No, I wouldn't</p> <p>22 say. I wouldn't agree with that, no.</p> <p>23 (Blount Exhibit 8 marked for</p> <p>24 identification.)</p> <p>25</p>	<p>1 Do you see that?</p> <p>2 A. Uh-huh.</p> <p>3 Q. You said, "Dear Mr. Hatcher,</p> <p>4 according to your letter of March 31, 1998,</p> <p>5 I've written and enclosed a report on the</p> <p>6 occurrence, regulation and up-to-date</p> <p>7 scientific views of asbestos, amphiboles and</p> <p>8 intermediate fibers. I've also enclosed</p> <p>9 copies of my 1990 and '91 papers, one of</p> <p>10 which I'm sure you already have."</p> <p>11 Do you see where I'm reading?</p> <p>12 A. Uh-huh.</p> <p>13 Q. Now, you said this: "The 1991</p> <p>14 paper was written because I became aware it</p> <p>15 was a common opinion among industrial</p> <p>16 hygienists that industrial talcs were better</p> <p>17 than pharmaceutical and cosmetic talcs</p> <p>18 because there was a regulation for the former</p> <p>19 and not the latter. I knew this was not the</p> <p>20 case and wanted to set the record straight."</p> <p>21 Do you see where I'm reading?</p> <p>22 A. Uh-huh.</p> <p>23 Q. "Although my papers report an</p> <p>24 improved method for analysis" --</p> <p>25 And for the jury, we call that</p>

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<p>1 the Blount method, but I'm not -- they can 2 read the paper if they want to see that. 3 -- "the determinations for the 4 sample labeled I, Johnson & Johnson's Vermont 5 talc, have been done by the traditional 6 methods as well." 7 So in addition to your Blount 8 method, did you test it by traditional means? 9 A. Uh-huh, yes. 10 Q. "As I told you, I believe that 11 Johnson & Johnson's Vermont talc contains 12 trace amounts of asbestos which are well 13 below those specified by OSHA." 14 A. Uh-huh. 15 Q. That's what you said, isn't it? 16 A. Uh-huh. 17 Q. "It should be noted that the 18 proposed FDA regulation, which was never 19 finalized, also specified the same .1 percent 20 limit for amphibole asbestos as OSHA." 21 Now, you are not a 22 toxicologist; is that fair? 23 A. That's fair, yes. 24 Q. So you don't know what level is 25 safe or unsafe, and you haven't done studies</p>	<p>1 That means we got this document 2 from Johnson & Johnson; not from you. 3 MR. DUBIN: Object to form. 4 QUESTIONS BY MR. LANIER: 5 Q. Have you even seen this 6 document before I showed it to you? 7 Had you seen this document 8 since you wrote it? 9 A. I don't think so. 10 (Blount Exhibit 9 marked for 11 identification.) 12 QUESTIONS BY MR. LANIER: 13 Q. All right. So if we look, for 14 example, at representations made by the 15 company, here's one on their website. I'll 16 label it as Exhibit Number 9. It talks about 17 the facts about talc safety. 18 February 24, 2016, this is just 19 on the website, blogj&j.com. "Baby powder 20 made from cosmetic talc is one of Johnson's 21 oldest products and a long-time part of baby 22 care ritual." 23 This is the stuff used on 24 babies, right? 25 MR. DUBIN: I'm going to object</p>
Page 39	Page 41
<p>1 on the health effects; you just know asbestos 2 when you see it. 3 Is that right? 4 A. That's right. That's right. 5 Right. 6 MR. DUBIN: Object to form. 7 QUESTIONS BY MR. LANIER: 8 Q. Excellent. 9 And did you let the lawyers 10 know about the Johnson & Johnson talc having 11 these trace amounts of asbestos in this 12 letter? 13 A. Did I tell who? 14 Q. Yeah. 15 Yeah, you didn't hide it, did 16 you? 17 A. No. 18 Q. All right. And by the way, we 19 know that also because down in the corner of 20 this letter -- see, here's the letter. Down 21 in the corner it's got these numbers, 22 J&J-049150. 23 Do you see that? 24 A. Uh-huh. 25 Q. I'll highlight it.</p>	<p>1 to form on that question and have a 2 subsequent objection with the document 3 with this witness. 4 QUESTIONS BY MR. LANIER: 5 Q. Do you see where I'm reading? 6 A. I see that. 7 Q. And all I'm doing is setting up 8 a context here for the statement I'm going to 9 ask you about. 10 "Johnson's baby powder 11 continues to be popular with adults as well, 12 and in many parts of the world, it remains an 13 essential part of makeup and skin care 14 routines." 15 Do you see where it says that? 16 A. Uh-huh. 17 Q. Now, if you look at the very 18 first bullet point here, zoom in a little 19 bit, "A frequent misperception is that 20 Johnson's baby powder contains talc made with 21 asbestos, a substance classified as 22 cancer-causing. Since the 1970s, talc used 23 in consumer products has been required to be 24 asbestos-free." 25 Do you see where I'm reading</p>

11 (Pages 38 to 41)

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<p>1 that?</p> <p>2 A. Yes.</p> <p>3 Q. Dr. Blount, based upon what you</p> <p>4 know from what you did and your expertise,</p> <p>5 was Johnson & Johnson's baby powder in the</p> <p>6 19 -- since the 1970s asbestos-free or did it</p> <p>7 have asbestos in it?</p> <p>8 MR. DUBIN: Objection. Form.</p> <p>9 THE WITNESS: It had asbestos.</p> <p>10 MR. LANIER: Okay. Thank you.</p> <p>11 I'll pass the witness. Let's</p> <p>12 go off the record.</p> <p>13 VIDEOGRAPHER: Going off the</p> <p>14 record. The time is 9:59.</p> <p>15 (Off the record at 9:59 a.m.)</p> <p>16 (Blount Exhibit 10 marked for</p> <p>17 identification.)</p> <p>18 MR. LANIER: I told Mr. Dubin</p> <p>19 before we started I have told</p> <p>20 Dr. Blount that we would compensate</p> <p>21 her for her time. I know that the</p> <p>22 geologist fact witness for the company</p> <p>23 was charging -- Pooley charged around</p> <p>24 \$400 an hour I think he said. So</p> <p>25 we're going to be paying her that</p>	<p>1 testimony this morning, had you set or</p> <p>2 decided on any particular rate by which you</p> <p>3 would be paid?</p> <p>4 A. Yes.</p> <p>5 Q. Okay. When did you make that</p> <p>6 decision? What rate were you going to be</p> <p>7 paid?</p> <p>8 A. \$400 an hour or something like</p> <p>9 that.</p> <p>10 MR. LANIER: Yeah.</p> <p>11 QUESTIONS BY MR. DUBIN:</p> <p>12 Q. And when was that rate decided</p> <p>13 on?</p> <p>14 A. I don't really know --</p> <p>15 MR. LANIER: Yeah. Yeah, I met</p> <p>16 with her a week ago. So it would have</p> <p>17 been a week ago, probably.</p> <p>18 QUESTIONS BY MR. DUBIN:</p> <p>19 Q. But the actual rate, was that</p> <p>20 just decided during the break that we've had</p> <p>21 in between your testimony for Mr. Lanier?</p> <p>22 A. No.</p> <p>23 Q. Okay. So you're representing</p> <p>24 that the rate was decided on weeks ago?</p> <p>25 MR. LANIER: No, about a week</p>
Page 43	Page 45
<p>1 time. I don't know what her time is.</p> <p>2 I don't know how much time she's got</p> <p>3 in it. Whatever it is, we're going to</p> <p>4 be paying that, and I don't want the</p> <p>5 other side not to be aware of that. I</p> <p>6 told Mr. Dubin but not Mr. Prost or</p> <p>7 the judge. Put that on the record.</p> <p>8 JUDGE NORTON: When Mr. Prost</p> <p>9 comes back in, I'll mention it to him</p> <p>10 if you've started or whatever.</p> <p>11 MR. LANIER: Thank you.</p> <p>12 VIDEOGRAPHER: Back on the</p> <p>13 record. The time 10:05.</p> <p>14 CROSS-EXAMINATION</p> <p>15 QUESTIONS BY MR. DUBIN:</p> <p>16 Q. Hi, Dr. Blount. How are you?</p> <p>17 A. I'm fine.</p> <p>18 Q. Okay. During the break, just</p> <p>19 to address first, counsel who is here with</p> <p>20 you, Mr. Lanier, indicated that you're being</p> <p>21 paid for your time and for the time that you</p> <p>22 met with Mr. Lanier previously; is that</p> <p>23 correct?</p> <p>24 A. That's correct.</p> <p>25 Q. Okay. And prior to your giving</p>	<p>1 ago when I met her, I told her that</p> <p>2 whatever Pooley had charged is what</p> <p>3 we'd -- we'd pay her that hourly rate</p> <p>4 that you-all set for the geologist.</p> <p>5 QUESTIONS BY MR. DUBIN:</p> <p>6 Q. All right. Let's start with</p> <p>7 some basic concepts.</p> <p>8 There have been some words that</p> <p>9 were used, if we can turn on the Elmo.</p> <p>10 All right. Amphibole. What is</p> <p>11 an amphibole?</p> <p>12 A. It's a silicate mineral.</p> <p>13 Q. Does amphibole mean asbestos?</p> <p>14 A. Not -- not always. I think</p> <p>15 there's some that are not considered</p> <p>16 asbestos. It's a group -- amphibole is a</p> <p>17 group of mineral. So, yeah.</p> <p>18 Q. So there are asbestos</p> <p>19 amphiboles and there are non-asbestos</p> <p>20 amphiboles, right?</p> <p>21 A. (Witness nods head.)</p> <p>22 Q. And another word that we were</p> <p>23 talking a good bit about is tremolite?</p> <p>24 A. Uh-huh.</p> <p>25 Q. Now, is there also asbestos</p>

12 (Pages 42 to 45)

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<p>1 tremolite and non-asbestos tremolite? 2 A. Yes, I would say so. 3 They're -- because sometimes it's sort of 4 blocky and other times it is a definite 5 fiber. So you have -- you have to make a 6 decision when you see it. 7 And that's why I did that graph 8 he showed earlier. You can see which ones 9 had an asbestiform form shape and which ones 10 don't. That's what you have to do to make 11 sure that you're getting one that's actually 12 asbestos or not. 13 Q. Right. 14 And so, for example, there's 15 another term that's also used. 16 A. Cleavage, yeah. 17 Q. Fragments, right? 18 A. Yeah. 19 Q. Cleavage fragments, right? 20 Is that a term that you're 21 familiar with? 22 A. Yes. 23 Q. And what is a cleavage 24 fragment? 25 A. That's the way the mineral will</p>	<p>1 Q. 1996. 2 Okay. And then presumably you 3 took some out of that bottle to do your 4 analysis of Sample I? 5 A. Uh-huh. 6 Q. And the first analysis that you 7 have of Sample I -- I think we looked at this 8 document a little bit a second ago. Okay. 9 So this was the letter that 10 Mr. Lanier showed you to Mr. Hatcher -- 11 A. Uh-huh. 12 Q. -- and it attaches a paper, 13 "The Detection and Quantification of Asbestos 14 and Other Trace Minerals." 15 And that's from -- is that 16 1990? 17 A. I can't see it from here. 18 Q. There's a date on the bottom. 19 MR. LANIER: I can't see it. 20 QUESTIONS BY MR. DUBIN: 21 Q. Well, do you still have a copy 22 of the document that -- 23 A. With everything -- 24 MR. COOPER: It's in the bottom 25 right corner.</p>
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<p>1 actually break if you hammer it or something 2 so that you can -- you know, you break it. 3 It'll break along these cleavage lines, which 4 is an inherent structure of the crystal to 5 start out with. 6 Q. And is it fair to say that a 7 cleavage fragment of tremolite is not 8 asbestos? 9 A. I would say so, although there 10 are others that do not -- some people don't 11 say that. Some people count everything. 12 Q. Right. 13 A. But if there's a cleavage 14 fragment, I would not count it as asbestos. 15 Q. Okay. And so if I understand 16 your testimony correctly, your sample that -- 17 Sample I that you mentioned, you're saying 18 that that was a -- bought from a bottle of 19 Johnson & Johnson's baby powder? 20 A. Yeah. Baby powder, yeah. 21 Q. Okay. So when did you purchase 22 that bottle? 23 A. I think I purchased it right 24 before I left New Jersey, which would be 25 1996.</p>	<p>1 THE WITNESS: 1990, yeah. 2 QUESTIONS BY MR. DUBIN: 3 Q. And so we'll go into this a 4 little bit in depth, but why is it that you 5 remember the timing of when you bought that 6 Johnson & Johnson bottle? 7 What brings to mind when you 8 did it? 9 A. Because we were about ready to 10 come up here and move -- we were about ready 11 to move up here, and I remember I got it 12 right before we moved up here. 13 Q. So when did you move up here? 14 A. 1996. 15 Q. Okay. And so one of the things 16 about this paper -- and I'm sorry for people 17 I'm making seasick with the Elmo -- you have 18 an analysis that we talked about a little bit 19 before of Sample I. 20 Do you see that? 21 A. I, yeah. 22 Q. All right? 23 A. Uh-huh. 24 Q. And now that Sample I, did 25 you -- did you -- you've done other studies</p>

13 (Pages 46 to 49)

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<p>1 that involve Sample I, right?</p> <p>2 A. Uh-huh. I think so.</p> <p>3 Q. Okay. And was Sample I always</p> <p>4 the same material, as far as you know, or did</p> <p>5 you switch it around?</p> <p>6 A. It was the same material.</p> <p>7 Q. Okay. So let's look at -- I'm</p> <p>8 going to hand you -- I'll mark this</p> <p>9 separately.</p> <p>10 MR. DUBIN: What number are we</p> <p>11 on?</p> <p>12 (Blount Exhibit 11 marked for</p> <p>13 identification.)</p> <p>14 QUESTIONS BY MR. DUBIN:</p> <p>15 Q. Mark this as 11.</p> <p>16 And do you recognize what I've</p> <p>17 marked -- and I'll just put it up here -- as</p> <p>18 Exhibit 11?</p> <p>19 If you look at this, do you</p> <p>20 recognize this paper? It's the same thing</p> <p>21 that you have in front of you.</p> <p>22 A. Same thing I have...</p> <p>23 Q. The next page is a paper by</p> <p>24 you.</p> <p>25 A. Yes, I see that.</p>	<p>1 of view -- I'll point to it on the...</p> <p>2 A. Which one?</p> <p>3 Q. Do you see Sample I?</p> <p>4 A. I. I. Okay. Uh-huh.</p> <p>5 Q. And so there were no fibers</p> <p>6 detected in that Sample I by the traditional</p> <p>7 methods, right?</p> <p>8 A. Uh-huh.</p> <p>9 Q. Okay. But one thing we know</p> <p>10 then is that Sample I can't be the Johnson &</p> <p>11 Johnson baby powder that you said you bought</p> <p>12 in 1996, right?</p> <p>13 A. That seems so.</p> <p>14 (Blount Exhibit 12 marked for</p> <p>15 identification.)</p> <p>16 QUESTIONS BY MR. DUBIN:</p> <p>17 Q. And the same way we know this</p> <p>18 paper that we've all been talking about --</p> <p>19 I'm going to mark this next, Exhibit 12.</p> <p>20 A. Oh, we're doing this a</p> <p>21 different way.</p> <p>22 Q. Just showing you --</p> <p>23 A. We're doing this one a</p> <p>24 different way. This is a centrifuge way;</p> <p>25 this one's not.</p>
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<p>1 Q. Called "Detection and</p> <p>2 Quantification of Asbestos and Other Trace</p> <p>3 Materials {sic}."</p> <p>4 You looked at the front page of</p> <p>5 that before?</p> <p>6 A. Uh-huh.</p> <p>7 Q. And it indicates that this was</p> <p>8 presented at a proceedings of International</p> <p>9 Symposium of Applied Mineralogy in 1989,</p> <p>10 correct?</p> <p>11 A. (Witness nods head.)</p> <p>12 Q. And the date on this paper, we</p> <p>13 were trying to see it before, but now that</p> <p>14 you have your own copy, is it a little easier</p> <p>15 to see at the bottom of page 557 what the</p> <p>16 date is?</p> <p>17 A. Uh-huh. 1990, yeah.</p> <p>18 Q. Okay. And you'll see, for</p> <p>19 example, there's analysis. If you turn to</p> <p>20 Table 2 on 567, there's analysis of a</p> <p>21 Sample I.</p> <p>22 Do you see that?</p> <p>23 A. Sample.</p> <p>24 Q. Under the comparison of values</p> <p>25 obtained by traditional 1 milligram 100 field</p>	<p>1 QUESTIONS BY MR. DUBIN:</p> <p>2 Q. And also here we have this</p> <p>3 paper that -- the other paper Mr. Lanier</p> <p>4 asked you about, "Amphibole Content of</p> <p>5 Cosmetic and Pharmaceutical Talcs," by AM</p> <p>6 Blount.</p> <p>7 This is the paper you wrote,</p> <p>8 you talked about earlier?</p> <p>9 A. Uh-huh.</p> <p>10 Q. And this paper is dated 1991,</p> <p>11 correct?</p> <p>12 A. Uh-huh.</p> <p>13 Q. So whatever we're claiming --</p> <p>14 seeing in Sample I here can't be an analysis</p> <p>15 of the baby powder that you purchased in</p> <p>16 1996, correct?</p> <p>17 A. That was -- this one has --</p> <p>18 what was the date you said?</p> <p>19 Q. This is 1991.</p> <p>20 A. 1991. Well, yeah, I guess</p> <p>21 that's right.</p> <p>22 Q. Okay. So do you know -- now,</p> <p>23 let me also ask you: You maintained the</p> <p>24 samples that you've looked at in these papers</p> <p>25 for many years, right?</p>

14 (Pages 50 to 53)

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<p>1 A. Some of them, yeah, but not all 2 of them. 3 Q. For example, not very long ago 4 I believe that you gave certain samples to 5 Dr. Mickey Gunter that you had maintained, 6 including Sample I, correct? 7 A. I said it was Sample I. 8 Q. And just so we have it in the 9 record, I'll mark this as next in order. 10 (Blount Exhibit 13 marked for 11 identification.) 12 QUESTIONS BY MR. DUBIN: 13 Q. I know you're not aware of 14 this, but those samples have been made 15 available for testing by both plaintiff and 16 defense experts in this case. 17 MR. LANIER: No. 18 MR. DUBIN: You haven't seen 19 that letter? 20 MR. LANIER: Oh, I've seen the 21 letter, but you-all have not made them 22 available to us yet. 23 MR. DUBIN: Okay. We can -- 24 the letter will speak for itself. 25 THE WITNESS: But I -- that</p>	<p>1 was published? 2 A. No, it would have to be after 3 that. 4 Q. Why is that? 5 A. Because -- well, my 6 recollection is that the older sample was 7 obtained in New Jersey before I came up here. 8 The I that you're talking about 9 is something that I collected up here. 10 Q. Why did you label it then 11 Sample I? 12 A. Well, that's a good question. 13 What I usually did when I 14 was -- when I was collecting samples up here 15 is I usually just gave them a letter rather 16 than any other information on there 17 because -- and I put the number on the 18 bottom, a letter on the bottom, because when 19 I ran them, I didn't want to know who's they 20 were or where they came from. I just wanted 21 to look at them. 22 So, unfortunately, some of the 23 things ended up with a letter that I'd 24 already -- that had already been used before. 25 So that's why I have two letter I's.</p>
Page 55	Page 57
<p>1 sample's not the same one as this 2 other one. 3 QUESTIONS BY MR. DUBIN: 4 Q. So that I is not the same I? 5 A. No. 6 Q. So what is that I? 7 A. What's that I? It's a Vermont 8 talc, but I don't know where it came from. 9 Q. So is that the I that was 10 studied in the 1991 paper, the I that you've 11 provided for testing? 12 A. You mean with the -- that we 13 plotted out, you mean? 14 Q. Right. 15 Is the I that's described in 16 the 1991 paper the same I that you provided 17 to Dr. Gunter? 18 A. Huh-uh, no. 19 Q. So when did you obtain that 20 Sample I? 21 A. Most recent? 22 Can't tell you. I don't know. 23 I'd have to look at my records. 24 Q. Do you know whether you 25 obtained that Sample I before the 1991 paper</p>	<p>1 Q. Well, the other samples that 2 you gave to Dr. Gunter, did those letters 3 correspond to the correct samples back from 4 the 1991 paper? 5 A. No, because they'd have to 6 be -- they were collected up here. 7 Q. So was it -- do you still have 8 samples of other materials back from the 1991 9 papers? 10 A. I don't think so. 11 Q. So what were all those samples 12 that you gave to Dr. Gunter? 13 A. They were samples I collected 14 after I had moved up here. 15 Q. Weren't they from areas other 16 than Vermont? 17 A. They may be because I had some 18 graduate students, and I may have had some 19 talc from them, too. 20 Q. But didn't they all have 21 identification letters that corresponded to 22 the 1991 paper samples? 23 A. I'm not sure. 24 Q. Okay. Now, why did you 25 maintain -- why do you maintain samples? Why</p>

15 (Pages 54 to 57)

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<p>1 is it your practice to maintain samples? 2 A. I don't know. I like samples. 3 Q. What did the container of 4 Johnson & Johnson that you remember look 5 like -- that you remember using look like? 6 A. You want it? It's in my purse. 7 MR. LANIER: Sure. 8 MR. DUBIN: All right. We'll 9 mark that as the next exhibit in 10 order. 11 (Blount Exhibit 14 marked for 12 identification.) 13 QUESTIONS BY MR. DUBIN: 14 Q. Okay. 15 A. It has some kind of number on 16 the bottom. I don't know if it means 17 anything. 18 Q. Let me see -- 19 MR. LANIER: The bottom is 20 stamped 231 D2, if that helps you. 21 MR. DUBIN: It's stamped 22 231 D2. There's a number on the side 23 that says -- 24 THE WITNESS: It's a cast 25 number. It just says it's talc. The</p>	<p>1 Johnson & Johnson e-mailed you to ask you 2 some questions? 3 Do you recall that at all? 4 A. Huh-uh. 5 (Blount Exhibit 15 marked for 6 identification.) 7 QUESTIONS BY MR. DUBIN: 8 Q. Okay. See if this refreshes 9 your recollection. 10 Do you recall talking to -- do 11 you recall talking to Mr. Cooper in 12 connection with that e-mail? 13 MR. PROST: At some point I'd 14 like to take a look at it, too. 15 QUESTIONS BY MR. DUBIN: 16 Q. Do you recall reviewing a 17 report by Dr. Longo and then talking to 18 Mr. Cooper about what your views were about 19 it? 20 A. No. 21 Q. Do you recall receiving any 22 sort of report of an analysis of baby powder 23 by Dr. Longo? 24 A. Huh-uh. 25 Q. So you don't recall telling</p>
Page 59	Page 61
<p>1 computer tells you it's talc and 2 what -- if it's dangerous or not, and 3 that's what that number... 4 MR. DUBIN: It says, "Baby 5 products company, Skillman, 6 New Jersey, 08558, at J&J PPC." It's 7 got number 3011 DR. 8 QUESTIONS BY MR. DUBIN: 9 Q. And so this is the bottle that 10 you remember purchasing in 1996 before you 11 came up here, correct? 12 A. Uh-huh. 13 Q. Prior to 1996, had you obtained 14 talc from the Windsor area from any other 15 source that you can remember? 16 A. I don't remember. 17 Q. But it's fair to say that if 18 you had obtained talc from the Windsor, 19 Vermont, area prior to 1996, you don't know 20 what the source is, correct? 21 A. That's right. 22 Q. Trying to cut down a little 23 time, so moving around a little. 24 Do you recall sometime last 25 fall that an attorney, Jonathan Cooper, from</p>	<p>1 Mr. Cooper that you thought what he was 2 looking at wasn't asbestos? 3 A. (Witness shakes head.) 4 Q. So fair to say, though, to the 5 extent you've looked at Johnson & Johnson 6 baby powder, you've looked at one bottle? 7 A. No, I looked at -- over time 8 I -- every now and then I get one just to see 9 what it's looking like. 10 Q. Do you have any results of 11 other analysis that you can provide? 12 A. That I can dig out? 13 It would take a long time to 14 find it. Would you like to pay me for... 15 MR. LANIER: I'll make them pay 16 you for that. 17 QUESTIONS BY MR. DUBIN: 18 Q. At least in none of your 19 meetings for Mr. Lanier did he ask you to go 20 find any of that data, right? 21 A. No, he did not. He did not. 22 Q. Is it fair to say, though, that 23 if somebody claims to find, for example, one 24 tremolite structure, right, that happens to 25 be 3 to 1, that doesn't mean that they're</p>

16 (Pages 58 to 61)

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<p style="text-align: right;">Page 62</p> <p>1 finding asbestos necessarily, right?</p> <p>2 A. Right.</p> <p>3 Q. You would want to go and do</p> <p>4 additional analysis beyond seeing one</p> <p>5 tremolite particle to determine whether it</p> <p>6 was really asbestos or not, right?</p> <p>7 A. Right.</p> <p>8 Q. Okay. And you were asked about</p> <p>9 whether you had views on health effects,</p> <p>10 so -- but you're aware that there aren't</p> <p>11 studies showing that the nonasbestiform</p> <p>12 tremolites cause cancer, right?</p> <p>13 A. Right.</p> <p>14 Q. And is it your view that the</p> <p>15 nonasbestiform forms of tremolite do not</p> <p>16 cause cancer?</p> <p>17 MR. LANIER: I want to put an</p> <p>18 objection to form. We are not</p> <p>19 offering her as an expert. I don't</p> <p>20 think anyone has.</p> <p>21 MR. DUBIN: I think you've</p> <p>22 referred multiple times to her</p> <p>23 expertise in your questions, but we'll</p> <p>24 resolve it.</p> <p>25</p>	<p style="text-align: right;">Page 64</p> <p>1 look at Dr. Longo's report, right, the e-mail</p> <p>2 from Mr. Cooper?</p> <p>3 Do you see that?</p> <p>4 A. E-mail from Mr. Cooper?</p> <p>5 Q. Well, let me ask you: Did</p> <p>6 Mr. Lanier ever ask you to look at an</p> <p>7 expert's report called -- an individual,</p> <p>8 Dr. Longo, to see what your thoughts were</p> <p>9 about it?</p> <p>10 A. I don't remember.</p> <p>11 Q. Okay. And if somebody was to</p> <p>12 say that they didn't do an analysis by</p> <p>13 optical microscopy, by PLM, PCM, because you</p> <p>14 just can't see asbestos with it, would that</p> <p>15 be correct or incorrect?</p> <p>16 A. That's incorrect.</p> <p>17 Q. Okay. And in your 1992 --</p> <p>18 sorry, '91 article, you listed out the</p> <p>19 densities of various materials so that you</p> <p>20 could -- because you were using a heavy</p> <p>21 density liquid separation technique, correct?</p> <p>22 A. Yes.</p> <p>23 Q. So, for example, this is what</p> <p>24 we're talking about, this 1991 paper.</p> <p>25 Now, before I ask you that,</p>
<p style="text-align: right;">Page 63</p> <p>1 QUESTIONS BY MR. DUBIN:</p> <p>2 Q. Again, you're of the opinion</p> <p>3 that nonasbestiform tremolite does not cause</p> <p>4 cancer, right?</p> <p>5 That's been your opinion?</p> <p>6 A. I don't know.</p> <p>7 Q. Okay. But certainly you can't</p> <p>8 just come in and say that every tremolite</p> <p>9 particle that's over 3 to 1 that you find,</p> <p>10 that's asbestos, right?</p> <p>11 A. (Witness nods head.)</p> <p>12 Q. That wouldn't be a proper</p> <p>13 methodology?</p> <p>14 A. I mean -- I mean, I've been to</p> <p>15 conference and conference of geologists</p> <p>16 arguing about what is asbestos and what is</p> <p>17 not asbestos. So, I mean, geologists have</p> <p>18 not really reached a final conclusion on this</p> <p>19 either.</p> <p>20 The ASTM meetings I've been to,</p> <p>21 I don't know how many of them, and this is</p> <p>22 always the discussion, you know.</p> <p>23 Q. Okay. And to be fair, I know</p> <p>24 you don't recall, but that e-mail suggests</p> <p>25 that we did at some point ask you to take a</p>	<p style="text-align: right;">Page 65</p> <p>1 first, did you consider at the time this</p> <p>2 method to be experimental in nature?</p> <p>3 A. No.</p> <p>4 Q. The page here, you have various</p> <p>5 densities for materials -- I know it's hard</p> <p>6 to see, I'll try to zoom in -- including</p> <p>7 anthophyllite, tremolite, actinolite and</p> <p>8 talc, right?</p> <p>9 A. Uh-huh.</p> <p>10 Q. Was this method that you</p> <p>11 developed capable of separating out and</p> <p>12 detecting anthophyllite if it was there?</p> <p>13 A. Should be.</p> <p>14 Q. Okay. So if someone were to</p> <p>15 say that using your method, even if there was</p> <p>16 anthophyllite in a sample, they couldn't see</p> <p>17 it, that would be wrong, correct?</p> <p>18 A. It depends how they do the</p> <p>19 method. Because I -- to do this, I had to go</p> <p>20 through each mineral, and I had to find out</p> <p>21 its density.</p> <p>22 Q. Right.</p> <p>23 A. And I had to know what liquid</p> <p>24 to use, what density liquid. So it depends</p> <p>25 on what you're running together, and once you</p>

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<p style="text-align: right;">Page 66</p> <p>1 know that, you can figure out what liquid to 2 use. 3 You just can't take what's 4 written here and just do it that -- you know, 5 with that -- with those numbers. 6 Q. Right. Precisely. 7 You chose a liquid density that 8 would allow you to see not only tremolite but 9 other forms of amphibole, correct? 10 A. And I tested them out to see 11 what their density was, and then I had to 12 purchase a heavy liquid that fit right 13 between talc and these other ones so that I 14 could separate them out in -- what would come 15 to the bottom when I centrifuged it. And 16 then I took a little tiny pipette and I 17 removed those things from the bottom, and 18 that's what went onto my glass slides. 19 Q. Okay. And so if somebody 20 decides to use a different density liquid, 21 they're not using the same method you were? 22 A. Or if they're doing a different 23 density mineral, they would have to go 24 through that and decide which -- what liquid 25 they need to use.</p>	<p style="text-align: right;">Page 68</p> <p>1 for -- in this method. 2 Q. So you agree then that when 3 you're analyzing talc for asbestos, it's best 4 to start with an optical microscopy method 5 like PLM? 6 A. Right. 7 Q. And then you can take another 8 step, potentially, and also look at something 9 like transmission electron microscopy? 10 A. If you wanted to get a real 11 close-up view of that. But TEM is not good 12 for identifying lots of times. It's just 13 looking for the structures. 14 Q. Right. 15 PLM, one of the things that 16 it's better at than TEM is identifying 17 whether you're really looking at asbestos or 18 not as opposed to look -- just focusing on 19 something that may be a non-asbestos 20 amphibole, right? 21 A. Uh-huh. 22 Q. And so if you skip the PLM 23 stage, you're missing out on a lot of 24 important information that helps you tell 25 whether you're really looking at asbestos or</p>
<p style="text-align: right;">Page 67</p> <p>1 Q. And so if somebody, for 2 example, selected a density of liquid that 3 didn't allow them to see anthophyllite, they 4 could make that decision, but then it would 5 be a different method? 6 A. Uh-huh. 7 Q. Right? 8 A. Uh-huh. 9 Q. And you don't know what 10 method -- 11 A. I don't know what -- 12 Q. -- Dr. Longo used in this case? 13 A. I don't know the density of 14 anthophyllite right off my head either. 15 Q. Do you have an opinion on the 16 comparative ability of the TEM, transmission 17 electron microscopy, and something like 18 optical microscopy to resolve asbestos fibers 19 or see asbestos fibers? 20 A. TEM I would not do until after 21 I had done this, if I really want to look at 22 those, because sometimes when you get fibers, 23 you get them -- they're bundles. So that's 24 when we go to the TEM or -- to see those 25 fibers. Otherwise, I wouldn't be using them</p>	<p style="text-align: right;">Page 69</p> <p>1 not, correct? 2 A. Uh-huh. 3 Q. And in your view, in general, 4 to determine whether or not something is 5 asbestos or not, you don't want to just look 6 at one single structure; you want to look at 7 the characteristics of the population of the 8 fibers, right? 9 A. Uh-huh. 10 Q. Okay. And ignoring the 11 characteristics of the population of the 12 fibers is not, I take it, good science in 13 your view? 14 A. I don't think so, yeah. 15 Q. All right. And again, 16 Mr. Lanier didn't share with you any of the 17 reports or opinions of the experts like 18 Dr. Longo or Dr. Compton that he intends to 19 offer to the jury in this case, correct? 20 A. I didn't see any. 21 Q. Okay. And are you aware that a 22 number of other researchers over time have 23 looked at Johnson & Johnson material to 24 determine whether or not they believe that it 25 has asbestos in it?</p>

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<p style="text-align: right;">Page 70</p> <p>1 A. Oh, I assume they have.</p> <p>2 Q. Okay. And let me just ask you</p> <p>3 whether you're familiar with some of them</p> <p>4 or -- at the time. I'll mark this as next in</p> <p>5 order.</p> <p>6 (Blount Exhibit 16 marked for</p> <p>7 identification.)</p> <p>8 QUESTIONS BY MR. DUBIN:</p> <p>9 Q. Is this a paper that you're</p> <p>10 familiar with?</p> <p>11 A. No.</p> <p>12 Q. Occupational Exposures. I'll</p> <p>13 put it up here.</p> <p>14 So this is not something --</p> <p>15 when you were asked this morning by</p> <p>16 Mr. Lanier about the presence of asbestos in</p> <p>17 Johnson & Johnson products, it's not</p> <p>18 something that you had had an opportunity to</p> <p>19 consider before expressing any views you have</p> <p>20 about that, right?</p> <p>21 A. Say that again?</p> <p>22 Q. Well, you were asked this</p> <p>23 morning by Mr. Lanier about whether there's</p> <p>24 asbestos in Johnson & Johnson baby powder,</p> <p>25 but this isn't something, this paper isn't</p>	<p style="text-align: right;">Page 72</p> <p>1 people, so why is that?</p> <p>2 Q. Do you know who John Dement is</p> <p>3 at -- was it NIOSH now?</p> <p>4 A. But he never comes to meetings</p> <p>5 or anything that we're having on asbestos.</p> <p>6 Q. Okay. Are you familiar with an</p> <p>7 organization McCrone, McCrone Industries?</p> <p>8 A. Uh-huh.</p> <p>9 Q. And you've cited to some of</p> <p>10 their work over time analyzing asbestos?</p> <p>11 A. Uh-huh.</p> <p>12 Q. Were you aware that McCrone was</p> <p>13 doing routine analysis of Johnson & Johnson</p> <p>14 talc for asbestos by transmission electron</p> <p>15 microscopy?</p> <p>16 A. Huh-uh.</p> <p>17 (Blount Exhibit 17 marked for</p> <p>18 identification.)</p> <p>19 QUESTIONS BY MR. DUBIN:</p> <p>20 Q. I know you haven't had an</p> <p>21 opportunity, I assume, to look at --</p> <p>22 Mr. Lanier didn't show you this document when</p> <p>23 he was preparing you to testify today,</p> <p>24 correct?</p> <p>25 MR. LANIER: Objection. Form.</p>
<p style="text-align: right;">Page 71</p> <p>1 something, that you were -- had considered in</p> <p>2 expressing any views you have about that,</p> <p>3 right, because you haven't read it?</p> <p>4 A. No, I haven't read it. No.</p> <p>5 Q. For example, this is</p> <p>6 individuals, Maryanne Boundy, William</p> <p>7 Burgess, John Dement, who is at NIOSH. And</p> <p>8 did you know that they went in to do a study</p> <p>9 of the Vermont mill and mine that made --</p> <p>10 that provided the source talc for Johnson &</p> <p>11 Johnson baby powder?</p> <p>12 A. Huh-uh.</p> <p>13 Q. And that they did -- they took</p> <p>14 product samples and they took air samples and</p> <p>15 that they analyzed those using techniques</p> <p>16 like PLM, optical microscopy and transmission</p> <p>17 electron microscopy?</p> <p>18 A. Huh-uh.</p> <p>19 Q. And that their conclusion was</p> <p>20 that there was no asbestos?</p> <p>21 You haven't seen that before?</p> <p>22 A. No.</p> <p>23 But I guess my question here</p> <p>24 is: I've been to so many asbestos</p> <p>25 conferences, and I have never heard of these</p>	<p style="text-align: right;">Page 73</p> <p>1 THE WITNESS: Yes.</p> <p>2 QUESTIONS BY MR. DUBIN:</p> <p>3 Q. Okay. And so this is a letter</p> <p>4 from McCrone -- McCrone Industries.</p> <p>5 A. Yeah, I know of them.</p> <p>6 Q. Yeah, McCrone Associates,</p> <p>7 sorry.</p> <p>8 A. Go ahead.</p> <p>9 Q. 1987. And it's talking about</p> <p>10 something with the EPA. It says, "The</p> <p>11 Illinois EPA wrote to Windsor Minerals to the</p> <p>12 effect that they were satisfied that</p> <p>13 Windsor's product is free of asbestos. That</p> <p>14 has always been our opinion and continues to</p> <p>15 be our opinion based on over 15 years of</p> <p>16 closely examining this product."</p> <p>17 And again, this was not</p> <p>18 something that you read or were shown by</p> <p>19 Mr. Lanier to talk about your views today,</p> <p>20 correct?</p> <p>21 MR. LANIER: Objection. Form.</p> <p>22 QUESTIONS BY MR. DUBIN:</p> <p>23 Q. Right?</p> <p>24 A. Right.</p> <p>25 Q. And are you aware that the FDA</p>

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<p>1 has done testing of talc for the presence of 2 asbestos? 3 Have you seen those testing 4 results? 5 A. Huh-uh. 6 Q. Okay. And you didn't look for 7 purposes of your 1991 paper at any Chinese 8 talc, correct? 9 A. No, I don't think so. 10 Q. And you did look, though -- 11 some of the other samples that you looked at 12 for your paper were raw ore samples from talc 13 from Vermont and ore samples from talc in 14 Italy, correct? 15 A. Well, it's -- raw samples? 16 Q. Well, what did you look at -- 17 what else did you look at from Vermont? 18 Sorry, I apologize. 19 A. Only what's in the talc 20 business. And I was working for them and 21 I -- and I analyzed those. And those were 22 coming in from Newfane and a Troy deposit. 23 And they were being processed in Chester and 24 in -- what's -- Johnson mills, and they came 25 to us. And then I had to analyze them</p>	<p>1 further, but cleavages and needles which -- 2 could be. Could be. 3 Q. Well, let's look at the 4 front -- let's look at the front of the 5 paper. 6 A. Uh-huh. 7 Q. You say, "Only one of the 8 samples was found to contain an amphibole 9 particle size distribution typical of 10 asbestos," correct? 11 Do you see that in the 12 abstract? "Only one"? 13 A. Oh, in the abstract. Okay. 14 "Only one found to contain 15 amphibole particles of size distribution of 16 typical asbestos." 17 Yeah, I agree. 18 Q. So that means the rest of the 19 samples, other than I, did not contain a 20 particle size distribution of amphibole 21 typical of asbestos, right? 22 A. Yeah, we've done this kind of 23 a -- we would have done this to see what the 24 distribution was. 25 Q. And that would include the</p>
Page 75	Page 77
<p>1 completely before they were -- became 2 products that the company would sell. 3 So I haven't had a chance to 4 look at those. 5 Q. So let's start first with just 6 Italian. 7 Did you look in the 1991 paper 8 also at Italian talc? 9 A. I think one of them was. 10 Q. And was your conclusion that 11 there was not asbestos in the Italian talc? 12 A. Do we have that paper? I think 13 I did. I'm not sure. 14 MR. LANIER: 1991? 15 MR. DUBIN: Yeah. 16 QUESTIONS BY MR. DUBIN: 17 Q. Is Italian talc H? 18 A. Let's see. Yes, something like 19 that. Let's see. 20 Well, in this paper it says 21 cleavages and needles. 22 Q. So your conclusion -- that was 23 not one of the samples that you identified 24 asbestos in, correct? 25 A. I guess I would have to look</p>	<p>1 Italian talc that you looked at and other 2 Vermont talcs that you looked at, correct? 3 A. Some -- I don't know if all of 4 them, but some of them are. 5 These were pretty much the ones 6 we were running to check our own deposits 7 that -- only its own deposits. 8 Q. Right. And so -- 9 A. But I know there was an 10 Italian, I remember that being there, but I 11 can't tell you right now which one it was. 12 Q. But fair to say that for the 13 Italian talc that you looked at, you didn't 14 find an amphibole particle size distribution 15 typical of asbestos, right? 16 A. Uh-huh. 17 Q. And you also, for the other 18 Vermont samples that you looked at, whatever 19 they are, you didn't find an amphibole 20 particle size distribution typical of 21 asbestos, right? 22 A. Yes, I think that's right. 23 Q. And just to clarify also, the 24 photos that Mr. Lanier showed of Sample I, do 25 you have other photos also, or are those all</p>

20 (Pages 74 to 77)

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<p>1 the photos that you have from that process?</p> <p>2 A. I don't think so. I don't</p> <p>3 think I have -- we had -- we had -- the</p> <p>4 problem was that when we moved its</p> <p>5 headquarters to Cincinnati, they got a new</p> <p>6 director to track that lab, and he threw out</p> <p>7 practically everything we had down here in</p> <p>8 Vermont. So a lot of that stuff was lost,</p> <p>9 and I'm afraid there's no way I can get it</p> <p>10 back.</p> <p>11 Q. So where did you get these</p> <p>12 photos?</p> <p>13 A. These were ones I already had,</p> <p>14 already printed out and, you know, I had</p> <p>15 those. But I have done a lot more work since</p> <p>16 then, and that does not exist anymore.</p> <p>17 Q. Okay. Did Mr. Lanier ask you</p> <p>18 to try to find any other photos that you had</p> <p>19 from your work or just those photos that you</p> <p>20 brought today?</p> <p>21 A. Well, I was looking through to</p> <p>22 see what I had, but knowing pretty much the</p> <p>23 timeline, I know at one point the new</p> <p>24 director decided to throw all of that stuff</p> <p>25 out, so...</p>	<p>1 CROSS-EXAMINATION</p> <p>2 QUESTIONS BY MR. PROST:</p> <p>3 Q. Good morning, Dr. Blount. My</p> <p>4 name is Mark Prost, and I represent a company</p> <p>5 called Imerys Talc America.</p> <p>6 A. Uh-huh.</p> <p>7 Q. Nice to meet you.</p> <p>8 A. Hi.</p> <p>9 Q. Now, you and I have never met</p> <p>10 or talked before; is that right?</p> <p>11 A. Right.</p> <p>12 Q. And I have not had coffee with</p> <p>13 you or had dinner with you, and I haven't</p> <p>14 sent you any information or e-mails or</p> <p>15 anything like that, have I?</p> <p>16 A. That's right, you haven't.</p> <p>17 Q. And has anyone from Imerys</p> <p>18 contacted you or tried to talk to you before</p> <p>19 the deposition?</p> <p>20 A. I don't think so.</p> <p>21 Q. All right. And I will say I</p> <p>22 would like to maybe have coffee with you,</p> <p>23 because I lived in Carbondale, Illinois, just</p> <p>24 like you did. I went to law school there.</p> <p>25 So maybe after the deposition we can catch up</p>
Page 79	Page 81
<p>1 Q. All right. And one of the</p> <p>2 things that you note in your conclusion</p> <p>3 section here is, "High grade talc powders are</p> <p>4 uniformly low in amphibole content. Indeed,</p> <p>5 talc from some districts appears to be</p> <p>6 completely free of such minerals."</p> <p>7 Do you see that?</p> <p>8 A. Uh-huh.</p> <p>9 Q. So if an expert for the</p> <p>10 plaintiffs was to testify there is no such</p> <p>11 thing as asbestos-free talc, is that true?</p> <p>12 A. There's no such thing...</p> <p>13 Q. If their experts would say it</p> <p>14 doesn't exist, there's no such thing as</p> <p>15 asbestos-free talc, is that true?</p> <p>16 A. No.</p> <p>17 MR. DUBIN: Okay. Let's take a</p> <p>18 five-minute break. I'll check my</p> <p>19 notes and see if I have anything else;</p> <p>20 otherwise, I'll pass back.</p> <p>21 VIDEOGRAPHER: Going off the</p> <p>22 record. The time is 10:50.</p> <p>23 (Off the record at 10:50 a.m.)</p> <p>24 VIDEOGRAPHER: Back on the</p> <p>25 record. The time is 10:54.</p>	<p>1 a little bit.</p> <p>2 Now, with the materials that</p> <p>3 Mr. Lanier showed you, did he show you any</p> <p>4 testing materials that my company, Imerys,</p> <p>5 had done regarding Vermont talc?</p> <p>6 A. I don't think so.</p> <p>7 Q. So there's going to be a woman</p> <p>8 from Imerys named Julie Pier who will</p> <p>9 testify, and the jury will hear about her,</p> <p>10 but she's going to talk about the testing</p> <p>11 that Imerys did.</p> <p>12 Are you aware of any of the</p> <p>13 testing that Imerys did or the results of</p> <p>14 that testing of Vermont talc?</p> <p>15 A. No.</p> <p>16 Q. You would agree it's a good</p> <p>17 thing for a talc company to test its talc to</p> <p>18 see if there is asbestos there, right?</p> <p>19 A. Right.</p> <p>20 Q. And would you expect a talc</p> <p>21 company to test for all kinds of asbestos</p> <p>22 such as tremolite and chrysotile?</p> <p>23 A. Uh-huh, yeah.</p> <p>24 Q. Now, your method, as I</p> <p>25 understand it, is designed to test for</p>

21 (Pages 78 to 81)

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<p>1 amphiboles but not chrysotile asbestos; is 2 that right? 3 A. I think you could do both. 4 Depends on, you know, which one it is, yeah. 5 Q. But as I understand it, your 6 heavy liquid density testing is designed such 7 that chrysotile is not going to be found 8 after that -- after the preparation is done. 9 They're not as likely to be found; is that 10 right? 11 A. Yeah, that's probably right. 12 Q. So if a talc company wanted to 13 test its talc to see if there's chrysotile 14 asbestos, it probably wouldn't be a good idea 15 to use your preparation method; is that -- 16 A. You just have to recalibrate 17 for whatever you are -- whatever mineral you 18 are interested in. 19 Q. All right. Now, my 20 understanding is the reason you developed 21 your technique was so you could test the talc 22 faster. Is that a fair way to describe it? 23 Why did you develop your 24 method? 25 A. I developed my method because I</p>	<p>1 I can look at the stuff I'm interested in and 2 the talc won't bother me, won't be in my way 3 so I can't find things. 4 Q. All right. When you developed 5 your method, was it your intention for it to 6 be used by lawyers or experts in litigation 7 to try to prove that asbestos was causing 8 someone's cancer? 9 A. No, I did it because only I 10 needed to know whether they had good talc or 11 not. And in fact, the two deposits that they 12 had at that time they no longer have because 13 they know what's in there, and that's what 14 they needed to know. 15 Q. And the two talc deposits, what 16 are you referring to? 17 A. I'm referring to Troy and 18 Newfane. 19 Q. Do you have any idea if Imerys 20 has ever mined talc from those two deposits? 21 A. I don't know. 22 MR. PROST: Ma'am, those are 23 all the questions that I have right 24 now, but I might have some later and I 25 might come back. Thank you.</p>
Page 83	Page 85
<p>1 wanted to be able to find the asbestos in 2 there, and most of the time there was so much 3 talc you couldn't find anything. And also 4 the asbestos fibers sometimes hid underneath 5 the talc particles, so I wanted to separate 6 them so I could see them and measure them. 7 And I couldn't do in its original condition. 8 Q. Now, there is an older way of 9 testing talc for asbestos that people were 10 doing before your method that took a lot 11 longer to do; is that true? Because of the 12 problems you just described? 13 A. I don't know how they did it. 14 Q. So, but one of the problems you 15 were coming across and why you tried to 16 develop your method was that when you were 17 testing pharmaceutical or cosmetic-grade 18 talc, there was such extremely low levels of 19 amphiboles that it was taking too much time 20 to do it, and you wanted to find a faster 21 method; is that fair? 22 A. No, I wanted to be able to find 23 it. You can't find it if you've got all of 24 that talc covering over what you're looking 25 for. So that's why I separate them, and then</p>	<p>1 VIDEOGRAPHER: Going off the 2 record -- 3 MR. LANIER: We don't need to 4 go off the record. We're going to 5 move. 6 MR. DUBIN: Should I have a 7 running objection to form or you want 8 me to make them all the time? 9 JUDGE NORTON: No, you don't 10 have to. I'll let Mr. Lanier tell me 11 if he wants to change that. 12 You know, I see the objections 13 to form being made primarily so that 14 if the counsel had asked a question 15 was to call you out and say what's 16 wrong with the form, that's the only 17 way to make sure -- if he doesn't 18 care -- 19 MR. LANIER: I don't care. 20 JUDGE NORTON: -- then they're 21 all preserved. 22 MR. DUBIN: All right. That's 23 great. That's what I figured. 24 JUDGE NORTON: So much easier. 25 I appreciate that.</p>

22 (Pages 82 to 85)

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<p>1 REDIRECT EXAMINATION 2 QUESTIONS BY MR. LANIER: 3 Q. All right. Dr. Blount, I want 4 to ask you some questions to clarify what's 5 been asked by the lawyers for Johnson & 6 Johnson and Imerys. 7 Okay? 8 A. Uh-huh. 9 Q. First of all, the Johnson & 10 Johnson lawyer asked you, are there different 11 kinds of amphiboles in tremolite, and you 12 said yes. 13 Remember that? 14 A. Uh-huh. 15 Q. My question, the important one, 16 is did you find tremolite asbestos in an 17 asbestiform in Johnson & Johnson baby powder? 18 Did you? 19 A. Yeah. 20 Q. Next subject. I was having 21 trouble understanding about 1996, 1991, 1989, 22 purchase of baby powder. 23 Did you test Johnson & Johnson 24 baby powder more than once? 25 A. Yes.</p>	<p>1 would have a letter I or maybe a letter A or 2 a letter B or a letter C for the different 3 samples, but would you change it each time? 4 A. Would I change it? 5 Q. Yeah. In other words, I 6 thought -- explain this to the jury. 7 You were telling Mr. Dubin you 8 assigned the letters so that it would be 9 blind. 10 A. Uh-huh. 11 Q. What does that mean? Explain 12 to the jury what you meant. 13 A. Because I didn't want to know 14 which company it was from. I wanted to -- 15 you know, because I think you might get bias 16 that way and I didn't want to. I wanted to 17 be fair. 18 Q. So if Mr. Dubin thought that 19 you would always give an I to Johnson & 20 Johnson, then it wouldn't be blind at all, 21 would it? 22 A. That's right. 23 Q. So would your I -- sometimes it 24 might be Johnson & Johnson -- 25 A. Uh-huh.</p>
Page 87	Page 89
<p>1 Q. And you may have written it up 2 once in a paper, but over the process of 3 however many times you tested it, did you 4 consistently find asbestos in it? 5 MR. DUBIN: Objection to form. 6 THE WITNESS: Yes. 7 QUESTIONS BY MR. LANIER: 8 Q. Now, you noticed when Mr. Dubin 9 handed you a different paper than the one you 10 and I had discussed -- it was a book 11 chapter -- 12 A. Uh-huh. 13 Q. -- you said that was a 14 different method, it was done at different 15 times. 16 I guess this goes back to the 17 other. Have you done these tests more than 18 once? 19 A. Which tests are we talking 20 about? 21 Q. Tests to see if there's 22 asbestos in Johnson & Johnson baby powder. 23 A. Yeah. 24 Q. All right. And then each time 25 you did it, if you had enough samples, you</p>	<p>1 Q. -- sometimes not; is that fair? 2 A. Yes, that's fair. 3 Q. That's how you make it blind, 4 right? 5 A. Right. 6 Q. All right. Next section, next 7 area, topic. Different methods of different 8 experts. 9 Now, Mr. Dubin put his own spin 10 into how he asked these questions -- 11 MR. DUBIN: Objection to form. 12 QUESTIONS BY MR. LANIER: 13 Q. -- and I want to make sure that 14 we're clear. 15 Before you criticize other 16 people and decide whether their science is 17 good or bad, would you want time to actually 18 look at what they did and understand it? 19 A. Uh-huh. 20 Q. Is it important to you to study 21 what they did and why they did it before you 22 criticize them? 23 A. Yeah. 24 Q. Thank you. 25 And in that same vein, if</p>

23 (Pages 86 to 89)

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<p style="text-align: right;">Page 90</p> <p>1 different methods are used by different 2 experts, would you agree that companies 3 should use the best method that actually 4 finds asbestos if they want to find it? 5 A. Yes. 6 Q. Is that important? 7 A. That's important. 8 Q. I mean, the company shouldn't 9 be playing -- okay. I got a 20-month-old 10 granddaughter. 11 MR. DUBIN: Object to form. 12 QUESTIONS BY MR. LANIER: 13 Q. And she's at the age now where 14 she likes to play hide and seek. 15 A. Uh-huh. 16 Q. And she'll play hide and seek 17 by pulling a napkin over her head at the 18 table, and I pretend I can't see her. And 19 she believes me when she drops the napkin 20 down and wants me to exclaim "there you are!" 21 Are you with me? 22 A. Uh-huh. 23 Q. I mean, a company should not be 24 playing hide and seek. A company should 25 really try to look for asbestos.</p> <p style="text-align: right;">Page 91</p> <p>1 Would you agree with that? 2 A. Yeah. 3 MR. DUBIN: Objection. Form. 4 QUESTIONS BY MR. LANIER: 5 Q. Now, next topic. A lot of 6 questions were asked by Mr. Dubin, and I 7 think even one by Mr. Prost, about what I 8 showed you, when Mr. Lanier and Mr. Dubin 9 said this -- this is lawyer questioning: 10 "When Mr. Lanier prepared to you testify." 11 Ma'am, I didn't prepare you to 12 testify in the sense of anything other than 13 just explain to you what a deposition is and 14 ask you to tell the truth; is that right? 15 A. That's right. 16 Q. And I didn't show you things, 17 you showed me things, because I just wanted 18 to know what you knew; is that fair? 19 MR. DUBIN: Objection. Form. 20 THE WITNESS: Uh-huh. 21 QUESTIONS BY MR. LANIER: 22 Q. I wanted to know what you did, 23 and that's all we talked about. I didn't 24 talk to you about what McCrone did, what 25 Julie Pier did or any of that, did I?</p>	<p style="text-align: right;">Page 92</p> <p>1 MR. DUBIN: Objection. Form. 2 THE WITNESS: No, you didn't. 3 QUESTIONS BY MR. LANIER: 4 Q. So, for example, when the 5 lawyers start asking you about this and they 6 talked about -- Mr. Dubin talked about what 7 McCrone said, I didn't even remotely get into 8 you about what Mr. McCrone -- or what McCrone 9 would say for J&J or for another company or 10 whatever versus what the truth is. 11 You and I never talked about 12 McCrone's testing, did we? 13 A. No, but he's dead anyway. 14 Q. He's dead anyway. 15 Is truth important in science? 16 A. Yes. Yes. Yes. 17 Q. Is it important that companies 18 tell the truth? 19 A. Yeah. 20 MR. DUBIN: Objection. Form. 21 QUESTIONS BY MR. LANIER: 22 Q. And so if, for example, we see 23 the Exhibit 16 that you were asked about 24 where -- or as Mr. Dubin showed from the 25 McCrone letterhead this comment that</p> <p style="text-align: right;">Page 93</p> <p>1 "Windsor's product is free of asbestos. 2 That's always been our opinion and continues 3 to be our opinion based over 15 years of 4 closely examining this product." 5 Do you see that? 6 A. Uh-huh. 7 Q. That's what was shown to you 8 just now by Mr. Dubin. 9 What Mr. Dubin never showed you 10 is what I'll mark as Exhibit Number 18. 11 (Blount Exhibit 18 marked for 12 identification.) 13 QUESTIONS BY MR. LANIER: 14 Q. Exhibit Number 18 is from that 15 same McCrone, the people who told everybody 16 that it's free of asbestos, that it's always 17 been their opinion after 15 years of closely 18 examining -- you can go back 12 years before 19 that, and that same McCrone says to Windsor, 20 the mine company, "We've analyzed your latest 21 series of 24 talc ore samples for asbestiform 22 minerals. In our entire series, we found 23 only two asbestiform fibers, both 24 amphiboles." 25 They made this with a</p>
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24 (Pages 90 to 93)

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<p>1 transmission electron microscope. So they 2 found two in that sample that they did that 3 day. 4 Do you see that? 5 A. Right. 6 Q. And yet they'll tell everyone 7 else that it's free of asbestos, Windsor's 8 product is free of asbestos, always been our 9 opinion. 10 Is it important that what you 11 tell the world be the truth that you actually 12 know? 13 Is that important? 14 A. Yeah. 15 Q. I mean, would you say if you 16 analyzed something, and in these 24 samples 17 that you got on this day you found a couple 18 of asbestiform fibers that were amphiboles -- 19 MR. DUBIN: Objection. Form. 20 QUESTIONS BY MR. LANIER: 21 Q. -- would you say that it's 22 asbestos-free? 23 A. No. 24 MR. DUBIN: Objection. Form. 25 (Blount Exhibit 19 marked for</p>	<p>1 references. The answer is obvious on who 2 wrote it. Regardless, I cannot agree with 3 the position. We just don't have enough 4 facts. Geologically, it doesn't make sense 5 to me you can have a mineral deposit that 6 just contains nonasbestiform tremolite. I 7 believe the USGS study of talc from Death 8 Valley, California, nailed it correctly. If 9 a deposit contains nonasbestiform tremolite, 10 there is also asbestiform tremolite naturally 11 present as well." 12 Would you agree with that? 13 In other words, if you've got 14 non -- 15 A. If you have -- I'm trying to -- 16 Q. Oh, I'm sorry. 17 A. So he said nonasbestiform 18 tremolite... 19 Q. I'll tell you what, I'm going 20 to move on in the interest of time. And 21 because I have not designated you as an 22 expert, I'm not sure that's a fair question 23 for me to ask. 24 A. Okay. 25 Q. Then the last thing I need to</p>
Page 95	Page 97
<p>1 identification.) 2 QUESTIONS BY MR. LANIER: 3 Q. All right. By the same token, 4 I'll show you Exhibit Number 18 which is from 5 the mine company. 19. 6 Let me mark that as Exhibit 18. 7 Let me show you Exhibit 8 Number 19. Here's a copy for you. 9 Exhibit Number 19. And again, 10 I didn't show you these things because I was 11 asking you about what facts you knew, right? 12 A. Uh-huh. Right. 13 Q. All right. But now if they 14 want me to show you these things, here's 15 another one about an article on asbestos, and 16 this is from within the company that's now -- 17 it's Rio Tinto Minerals at the time. It's 18 now known as Imerys. 19 But in the process of this, 20 they say on the second page, "I'd seen and 21 read this article, and my first reaction was, 22 'Who really wrote this paper for John's 23 signature?' I know John, he's a fairly 24 technical person, but excuse me, he would not 25 write such an article and cite 129</p>	<p>1 talk to you about in regards to what the 2 lawyers asked you is the lawyer from Imerys 3 asked you about Julie Pier's tests and 4 accused me of not showing you those. 5 I'm going to show you one of 6 those so that nobody feels I shorted you. 7 We'll mark this as Exhibit Number 20. 8 (Blount Exhibit 20 marked for 9 identification.) 10 QUESTIONS BY MR. LANIER: 11 Q. This is Julie Pier, Luzenac, 12 May of 2002, and this is her analysis of 13 fibrous material from the Argonaut waste 14 rock. 15 So this is rock that is left 16 over from their mining at Argonaut that 17 they're thinking about putting on our roads. 18 A. Uh-huh. 19 Q. It says -- and Argonaut, by the 20 way, that's Vermont; is that right? 21 A. Uh-huh, that's right. 22 Q. -- "a sample of fibrous 23 material from the waste rock on the west side 24 of the south end of the Argonaut, Vermont, 25 mine was submitted to the technical center</p>

25 (Pages 94 to 97)

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<p>1 for identification. Result: The fibrous 2 material is tremolite. This was examined by 3 polarizing light microscopy using the 4 dispersion staining technique." 5 That's yours, isn't it? 6 A. Uh-huh, that's the one we were 7 using, yeah. 8 Q. "Tremolite was preliminarily 9 identified by this method. Subsequent 10 analysis by scanning electron microscope and 11 transmission electron microscopy confirmed 12 the tremolite identification." 13 If we want to know if Julie 14 Pier thought there was asbestos in the 15 Vermont mines, I could have shown you this, 16 couldn't I? 17 MR. DUBIN: Objection. Form. 18 THE WITNESS: Uh-huh. 19 QUESTIONS BY MR. LANIER: 20 Q. I just didn't because I wanted 21 to know what you found. 22 MR. DUBIN: Objection. Form. 23 QUESTIONS BY MR. LANIER: 24 Q. Is that fair? 25 A. Yes, that's fair.</p>	<p>1 different each time so -- in different order 2 so that I don't -- have no idea which one's 3 which when I'm running it so I'm not biased 4 subconsciously, because that could happen. 5 So that's why I put these numbers. 6 Unfortunately, I didn't make a 7 good enough record, and I think some of them 8 got a little mixed up. 9 Q. And so I don't know if you 10 still have the exhibits with you; otherwise I 11 can mark something different. 12 But -- so we see -- can I turn 13 the Elmo back on, sir? 14 So this is -- we looked at this 15 before. It was Exhibit 8. And here you're 16 talking about how -- you're writing to the 17 lawyers for Johnson & Johnson and you're 18 saying, "Johnson & Johnson, I've looked at it 19 as labeled -- sample labeled I by traditional 20 methods. See Table 2, 567 in the 1990 21 paper," right? 22 A. Uh-huh. 23 Q. So this is the 1990 paper we 24 talked about that had some results for 25 Johnson & Johnson.</p>
Page 99	Page 101
<p>1 Q. And, ma'am, has your opinion 2 changed at all? Did you find asbestos in the 3 Johnson & Johnson baby products sold on the 4 shelves on multiple occasions? 5 A. I did. 6 MR. LANIER: Thank you. 7 Pass the witness. 8 RECROSS-EXAMINATION 9 QUESTIONS BY MR. DUBIN: 10 Q. Hey, how are you? We're almost 11 done. Don't worry about it. 12 Okay. So first, I didn't quite 13 understand your -- one thing that you were 14 talking about with Mr. Lanier, so I just want 15 to clarify it, this idea of blinding samples. 16 So as I understand it, if you 17 have a Sample I -- and, for example, let's 18 say that's a Johnson & Johnson product -- 19 then the next time you don't want that 20 Sample I necessarily to be Johnson & Johnson 21 because then you'll know what the results are 22 before you start, right? 23 A. I don't want to -- let me -- I 24 won't know -- even if I put "I" there, I 25 wouldn't know -- I want the letters to be</p>	<p>1 A. Uh-huh. 2 Q. So the next time you look at 3 Johnson & Johnson, though -- the next time 4 you have a Sample I, that's not going to be 5 Johnson & Johnson anymore, right? 6 A. Yeah, probably not. 7 Q. And so when you do your 8 analysis for your 1991 paper, "Amphibole 9 Content of Cosmetic and Pharmaceutical 10 Talcs," and you've got results for Sample I, 11 because you've randomly blinded this, it's 12 likely that I isn't going to be Johnson & 13 Johnson again, right? 14 A. Yeah, it may not be. 15 Q. Okay. And a couple other 16 questions. 17 So was this -- you were asked 18 about how many times you've looked at Johnson 19 & Johnson. 20 Was the bottle that we've got 21 as Exhibit 14, was that the first one that 22 you bought to analyze? 23 A. I bought that one last -- in 24 New Jersey. It may not have been the first 25 one.</p>

26 (Pages 98 to 101)

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<p>1 Q. Do you have any results of any 2 analysis that you did on any other bottles 3 than this one? 4 A. I'll have to look. I don't 5 know. 6 Q. Okay. And fair to say, though, 7 you've kept this bottle for now -- somebody 8 help me with the math -- 23? 22 years, 9 right? 10 A. 22 years. 11 Q. And if you had tested other 12 bottles of Johnson & Johnson, any reason that 13 you wouldn't have maintained those also? 14 A. I don't know. 15 Q. Okay. But at least sitting 16 here today, there's no results of any other 17 testing that I can take a look at that we 18 have with us, right? 19 A. With us today, don't think so. 20 Q. And one of the things you were 21 asked a little bit about was a document 22 pertaining to McCrone, some McCrone analysis 23 in the 1970s Mr. Lanier showed you, right? 24 A. Uh-huh. 25 Q. Do you even know whether the</p>	<p>1 Q. In particular, for example, 2 there may be areas towards the edges of talc 3 deposits where the talc comes into contact 4 with things like country rock, or you call it 5 black rock, or the like, right? 6 A. Uh-huh. 7 Q. And so at those edges of those 8 deposits, if you sample over there, you might 9 be more likely to find asbestos because it's 10 in conjunction with that harder rock mineral, 11 and there's also different minerals that can 12 come into play because of where it is 13 geologically, right? 14 A. Yes, they are not really 15 homogeneous, most deposits. 16 Q. And so it's important to 17 consider, when you're looking at a result of 18 a talc sample, where that talc sample was 19 actually taken from in a deposit, right? 20 A. Right. 21 Q. Okay. And you were asked a 22 little bit about hide and seek and all the 23 like. 24 First, do you agree that an 25 expert should not change their testing</p>
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<p>1 samples that were being analyzed in that -- 2 in that document were samples of talc that 3 would have gone into Johnson & Johnson baby 4 powder? 5 A. I don't think so. 6 Q. You don't know that, right? 7 A. Do you have that -- do you have 8 that thing to look at? 9 Q. Well, he gave you the document 10 before. 11 Well, for example, do you know 12 what the code HC means in that context? 13 A. HC? No. 14 Q. Do you know whether it could be 15 an industrial talc? 16 You just don't know how Johnson 17 & Johnson used those numbers, right? Or 18 letters, sorry. H is a letter. 19 A. No, I don't. 20 Q. And you were asked a little bit 21 about waste rock. 22 Is it fair to say that when you 23 look at a large talc deposit, there may be 24 geological diversity in that deposit? Right? 25 A. More than likely.</p>	<p>1 methodology just based on who is paying them 2 in a litigation? 3 A. Right. 4 Q. Right? 5 And do you agree that if you're 6 trying to answer the question whether there's 7 asbestos in a material, you should use 8 methods that help you distinguish between 9 asbestiform and nonasbestiform amphiboles, 10 right? 11 If that's the -- if the 12 question you're being asked is, is there 13 asbestos, you should use the right methods to 14 answer that question, right? 15 A. Right. 16 MR. DUBIN: No further 17 questions. 18 MR. PROST: No questions. 19 FURTHER REDIRECT EXAMINATION 20 QUESTIONS BY MR. LANIER: 21 Q. Dr. Blount, after all these 22 questions are said and done, after everything 23 that's been discussed, just based on what you 24 did in your work, in your life, never 25 dreaming lawyers would contact you, can you</p>

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<p style="text-align: right;">Page 106</p> <p>1 affirm that for decades, in the '80s and the 2 '90s, at least, into the 2000s, Johnson & 3 Johnson baby powder sold on the shelves had 4 asbestos and asbestiform in it? 5 MR. DUBIN: Objection. Form. 6 THE WITNESS: Yes. 7 MR. LANIER: Thank you. That's 8 all we've got. 9 FURTHER RECROSS-EXAMINATION 10 QUESTIONS BY MR. DUBIN: 11 Q. You were asked a very general 12 question by Mr. Lanier. 13 Do you agree that the best way 14 to determine whether or not there was 15 asbestos in these products is to look at the 16 actual testing results? 17 A. Look at test -- yeah. 18 Q. Right. 19 And so other than whatever we 20 have in your papers that you brought here 21 today, we have none of these test results 22 that you're supposedly relying on for 23 opinions in the '70s, '80s, '90s about 24 Johnson & Johnson talc to look at today, 25 right?</p>	<p style="text-align: right;">Page 108</p> <p>1 CERTIFICATE 2 3 I, CARRIE A CAMPBELL, Registered 4 Diplomate Reporter, Certified Realtime Reporter and Certified Shorthand Reporter, do 5 hereby certify that prior to the commencement of the examination, Alice M Blount, Ph D , 6 was duly sworn by me to testify to the truth, the whole truth and nothing but the truth 7 I DO FURTHER CERTIFY that the foregoing is a verbatim transcript of the 8 testimony as taken stenographically by and before me at the time, place and on the date 9 hereinbefore set forth, to the best of my ability 10 11 I DO FURTHER CERTIFY that I am neither a relative nor employee nor attorney 12 nor counsel of any of the parties to this action, and that I am neither a relative nor 13 employee of such attorney or counsel, and that I am not financially interested in the action 14 15 16 17 CARRIE A CAMPBELL, 18 NCRA Registered Diplomate Reporter Certified Realtime Reporter California Certified Shorthand 19 Reporter #13921 Missouri Certified Court Reporter #859 20 Illinois Certified Shorthand Reporter #084-004229 21 Texas Certified Shorthand Reporter #9328 Kansas Certified Court Reporter #1715 22 Notary Public 23 Dated: April 13, 2018 24 25</p>
<p style="text-align: right;">Page 107</p> <p>1 A. Yes. 2 FURTHER REDIRECT EXAMINATION 3 QUESTIONS BY MR. LANIER: 4 Q. But you're the one who did the 5 work, aren't you? 6 A. Yes. 7 Q. So these are your test results 8 you're talking about. We don't need a sheet 9 of paper, do we? 10 A. We're using kind of concept 11 method anyway. 12 MR. LANIER: Okay. Thank you. 13 MR. DUBIN: We can do this 14 forever, I suppose. All right. Let's 15 quit. 16 MR. LANIER: Thank you, 17 Dr. Blount. 18 VIDEOGRAPHER: This concludes 19 the April 13, 2018 deposition of 20 Dr. Blount. Going off the record. 21 The time is 11:25. 22 (Deposition concluded at 11:25 a.m.) 23 ----- 24 25</p>	<p style="text-align: right;">Page 109</p> <p>1 INSTRUCTIONS TO WITNESS 2 3 Please read your deposition over 4 carefully and make any necessary corrections. 5 You should state the reason in the 6 appropriate space on the errata sheet for any 7 corrections that are made. 8 After doing so, please sign the 9 errata sheet and date it. You are signing 10 same subject to the changes you have noted on 11 the errata sheet, which will be attached to 12 your deposition. 13 It is imperative that you return 14 the original errata sheet to the deposing 15 attorney within thirty (30) days of receipt 16 of the deposition transcript by you. If you 17 fail to do so, the deposition transcript may 18 be deemed to be accurate and may be used in 19 court. 20 21 22 23 24 25</p>

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<div style="text-align: center;">ACKNOWLEDGMENT OF DEPONENT</div> <p>I, _____, do hereby certify that I have read the foregoing pages and that the same is a correct transcription of the answers given by me to the questions therein propounded, except for the corrections or changes in form or substance, if any, noted in the attached Errata Sheet.</p> <p>_____ Alice M. Blount, Ph.D. DATE</p> <p>Subscribed and sworn to before me this _____ day of _____, 20 ____.</p> <p>My commission expires: _____</p> <p>Notary Public</p>	<div style="text-align: center;"> <div>-----</div> <div>LAWYER'S NOTES</div> <div>-----</div> </div> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 10%; text-align: center;">PAGE</th> <th style="width: 10%; text-align: center;">LINE</th> <th style="width: 80%;"></th> </tr> </thead> <tbody> <tr><td>1</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>2</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>3</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>4</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>5</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>6</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>7</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>8</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>9</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>10</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>11</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>12</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>13</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>14</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>15</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>16</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>17</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>18</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>19</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>20</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>21</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>22</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>23</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>24</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>25</td><td>_____</td><td>_____</td><td>_____</td></tr> </tbody> </table>		PAGE	LINE		1	_____	_____	_____	2	_____	_____	_____	3	_____	_____	_____	4	_____	_____	_____	5	_____	_____	_____	6	_____	_____	_____	7	_____	_____	_____	8	_____	_____	_____	9	_____	_____	_____	10	_____	_____	_____	11	_____	_____	_____	12	_____	_____	_____	13	_____	_____	_____	14	_____	_____	_____	15	_____	_____	_____	16	_____	_____	_____	17	_____	_____	_____	18	_____	_____	_____	19	_____	_____	_____	20	_____	_____	_____	21	_____	_____	_____	22	_____	_____	_____	23	_____	_____	_____	24	_____	_____	_____	25	_____	_____	_____
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Exhibit 35

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NO. 16-2738
(FLW) (LHG)

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I N D E X
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Testimony of: JOHN HOPKINS, Ph.D.

By Mr. Placitella 28

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MR. SILVER: Good morning, everyone. This is Mark Silver on behalf of Imerys. I notice in the room today there is a Dr. Egilman who is not counsel of record.

It is Imerys' position that this is a violation of CMO 11 to have him present. This is J&J's dep, and I will allow them to determine whether or not they ask him to leave, but Imerys objects. In Imerys depositions, we will not allow non-counsel to be present.

Also to the extent that Imerys and Dr. Egilman are having disputes in other jurisdictions as to what is determined to be a confidential document, we will remind the PSC that if Imerys confidential documents are to be used in this deposition, they are subject to a protective order and disclosure and will be -- remedies

1 will be sought if they are
2 disclosed. That's it.

3 MR. LOCKE: PCPC joins.

4 MR. BICKS: This is Peter
5 Bicks for Johnson & Johnson. I
6 guess I would ask -- is it
7 Mr. Placitella? You're taking the
8 deposition?

9 MR. PLACITELLA: I am.

10 MR. BICKS: It was brought
11 to my attention that there is a
12 Case Management Order Number 11
13 that I gather the parties have
14 agreed to that defines who may be
15 present at the deposition.

16 And it specifically lists
17 who those -- who may be at this
18 deposition. I guess I'm just
19 asking your position on the
20 presence of Dr. Egilman within the
21 confines of the court order,
22 because I don't want to be in a
23 position of in any way violating
24 any court order. And I'm happy to

1 show you the provision if you
2 haven't seen it.

3 MR. PLACITELLA: I think I
4 know what you're talking about.
5 But you can read into the record
6 whatever you think is appropriate.

7 MR. BICKS: Right. So this
8 is Case Management Order Number
9 11, and it's Paragraph 3. It
10 says, "Who may be present at the
11 deposition."

12 And it says, "Unless
13 otherwise ordered under Federal
14 Civ Pro 26(c) or otherwise agreed
15 to by the PSC or defense lead or
16 liaison counsel, depositions may
17 be attended in person only by
18 counsel of record in this MDL or
19 state court talc counsel of record
20 and employees of their firms who
21 are assisting in the litigation
22 and whose presence is reasonably
23 required by the attorney,
24 attorneys especially engaged by a

1 party for purposes of the
2 deposition, the parties or the
3 representative of a party,
4 including inhouse counsel, court
5 reporters, videographers, the
6 deponent and counsel for the
7 deponent.

8 "Upon application and for
9 good cause shown, the Court may
10 permit attendance by a person who
11 does not fall within any of the
12 categories set forth in the
13 preceding sentence.

14 "While the deponent is being
15 examined under any stamped
16 confidential document or the
17 confidential information contained
18 therein, persons to whom
19 disclosure is not authorized under
20 an MDL 2592 protective order shall
21 be excluded from the deposition."

22 That's what this order says.
23 I have seen orders in other cases
24 where experts, consultants are

1 allowed in depositions. It's just
2 that the order that the parties
3 and the court has in place here
4 doesn't have that provision that
5 I've seen in other cases. And I
6 don't want to be somebody
7 violating a federal court order.

8 So I assume you've looked at
9 this, know all about it, and
10 there's something that explains
11 it. But I -- this is what the
12 order says.

13 MR. PLACITELLA: Well, I'll
14 let Ms. Parfitt address that. But
15 this is what I understand. Two
16 days ago we gave notice that
17 Dr. Egilman would be here as our
18 consultant.

19 There was an exchange
20 yesterday with Susan Sharko
21 specifically about his attendance.
22 She asked in what capacity was he
23 coming. We indicated that he was
24 coming as our consultant, and no

1 objection was raised.

2 Based on the fact that no
3 objection was raised until two
4 minutes ago, Dr. Egilman traveled
5 here from Providence, and I guess
6 unless you're now raising an
7 objection that should have been
8 raised before, we're ready to
9 proceed.

10 MR. SILVER: For the record,
11 are you representing that the
12 notification went to me?

13 MR. LOCKE: Or to me?

14 MS. O'DELL: Well, those
15 communications were to Ms. Sharko
16 and you were on those e-mails.

17 MR. BICKS: Yeah, that was
18 yesterday.

19 MS. PARFITT: Yesterday
20 morning.

21 MR. BICKS: Right.

22 MS. O'DELL: And trusting
23 that Susan would convey that to
24 you.

1 MR. BICKS: Right.

2 MS. O'DELL: Our position is
3 that there could be an agreement
4 of the parties for a person to
5 attend. And to the degree that
6 the order requires protective
7 order being signed, Dr. Egilman
8 has done that. There's compliance
9 in that regard.

10 MS. PARFITT: Susan has been
11 notified. If there's a change in
12 the deposition, someone has taken
13 the lead from J&J to communicate
14 or Imerys. And Mark has always
15 taken the lead of circulating
16 information. I suspect what
17 happened here is that was not done
18 by Susan.

19 MR. LOCKE: I guess I'm
20 often in the dark about changes.
21 So for the future, if you have
22 something that affects all the
23 parties, and most of it this does,
24 including who attends a

1 deposition, you should give notice
2 to everyone. It's not that hard.
3 Just two or three names on an
4 e-mail.

5 MR. PLACITELLA: Fair
6 enough. If you'll have a real
7 issue about me asking a question
8 using an Imerys document, we can
9 address it at that time.

10 And if you have a problem
11 with it, we'll ask Dr. Egilman to
12 leave the room if you really have
13 a problem with it when I ask him
14 about an Imerys document, if
15 that's a problem, which I think
16 there are about eight in my box of
17 250.

18 MR. SILVER: I put my
19 objection on the record. We
20 can -- I'm not going to stop the
21 dep. We'll go forward, and we'll
22 deal with Imerys documents as they
23 come.

24 MR. PLACITELLA: All right.

1 I don't want to have an issue.

2 MR. LOCKE: Same for the
3 Personal Care Products Council.

4 MR. PLACITELLA: If I find a
5 document of yours during the dep,
6 I'll make the same offer. I'm not
7 sure there's one in that box. But
8 maybe you've got a few over there
9 that we can talk about.

10 MR. BICKS: The
11 representation was made on the
12 record that Dr. Egilman has signed
13 the confidentiality order in the
14 case. May I have a copy of that,
15 please.

16 MS. O'DELL: I don't have it
17 with me.

18 MR. BICKS: But you made a
19 representation on the record that
20 it's already been signed.

21 MS. O'DELL: That's my
22 understanding.

23 MR. PLACITELLA: If there is
24 an issue, he'll re-sign it now.

1 MR. BICKS: I think we
2 should have it signed --

3 MR. PLACITELLA: He agrees
4 to be bound.

5 MR. BICKS: -- and
6 completed. Okay. And we can just
7 have it completed, that would be
8 wonderful.

9 MR. PLACITELLA: No problem.

10 MR. BICKS: Thank you.

11 MR. PLACITELLA: We can sign
12 it during the break, so we don't
13 have to.

14 MR. BICKS: But you've
15 already said it's been signed.

16 MS. O'DELL: That's my
17 understanding. I don't have a
18 copy with me. If you want him to
19 sign it again. I would just need
20 some help filling it out.

21 MR. PLACITELLA: We can do
22 it now if you want.

23 MR. BICKS: Let's go. You
24 said it's already been signed.

1 MR. PLACITELLA: Yeah, but
2 in case somebody made a mistake, I
3 don't want to have an issue. So
4 if you want to take two minutes
5 and let him sign.

6 MR. KLATT: Y'all agree that
7 he's bound by it. As far as I'm
8 concerned, he can just produce one
9 at the next break.

10 MR. PLACITELLA: All right.
11 But all I'm saying if there is a
12 mistake and he signed all the
13 state ones and not the federal
14 ones, I don't want to have an
15 issue. If you want him to sign it
16 before we start, let him sign it.

17 MR. KLATT: Look, your
18 counsel has represented that he
19 signed it. Whether he has or not,
20 you all agree he's bound by it. I
21 think we're good to go till the
22 next break.

23 - - -

24 THE VIDEOGRAPHER: We are

1 now on the record. My name is
2 Henry Marte. I'm a videographer
3 with Golkow Litigation Services.

4 Today's date is August 16,
5 2018. And the time is 9:39 a.m.

6 This videotaped deposition
7 is being held at 51 West 52nd
8 Street, New York, New York, in the
9 matter of talcum powder
10 litigation.

11 The deponent today is John
12 Hopkins.

13 All appearances will be
14 noted on the stenographic record.

15 Will the court reporter
16 please administer the oath to the
17 witness.

18 - - -

19 ... JOHN HOPKINS, Ph.D.,
20 having been first duly sworn, was
21 examined and testified as follows:

22 - - -

23 EXAMINATION

24 - - -

1 BY MR. PLACITELLA:

2 Q. Good morning, Dr. Hopkins.

3 A. Good morning.

4 Q. Nice to see you again.

5 We're here for purposes of
6 your -- taking your deposition, you're --
7 have been designated as the corporate
8 representative of Johnson & Johnson in
9 these cases.

10 You're aware of that?

11 A. I am indeed, yes.

12 Q. Okay. You have in front of
13 you a notice of deposition that was
14 served in this case and that you are
15 testifying pursuant to.

16 (Document marked for
17 identification as Exhibit
18 Hopkins-1.)

19 BY MR. PLACITELLA:

20 Q. Do you want to show it to
21 your counsel?

22 A. Yes, I have seen this.

23 Q. Okay. And you understand
24 that you're here to address the topics

1 that are listed in that notice?

2 A. I do, yes.

3 Q. Okay. You understand that,
4 just to go brief -- go over briefly, in
5 this deposition you're here to address,
6 on behalf of Johnson & Johnson, the
7 composition of Johnson & Johnson's talcum
8 powder products, correct?

9 A. Correct.

10 Q. That would include the
11 identity of Johnson & Johnson's talcum
12 powder products, correct?

13 A. Yes.

14 Q. The formulas and composition
15 of Johnson & Johnson's talcum powder
16 products?

17 A. Yes.

18 Q. Correct?

19 The suppliers and mines that
20 are responsible for the Johnson & Johnson
21 talcum powder products, correct?

22 A. Correct, yes.

23 Q. You are here to testify
24 concerning the entities responsible for

1 the composition and purity testing and
2 standards relating to those products?

3 A. Yes, correct.

4 Q. The location and owner of
5 the talc lines that supply the J&J talc?

6 A. Yes.

7 Q. The talc composition and
8 purity testing and processing entities?

9 A. Yes.

10 Q. The allowable amounts of
11 non-talc constituents in J&J talcum
12 powder products?

13 A. Yes.

14 Q. The testing of talc intended
15 for use in the talcum powder products?

16 A. Yes.

17 Q. That would include
18 sensitivity and specificity testing?

19 A. Yes.

20 Q. The testing for asbestos and
21 other contaminants?

22 A. Yes, correct.

23 Q. The identity of testing
24 methodologies that were available, both

1 used and not used?

2 A. Yes.

3 Q. Testing protocols?

4 A. Yes.

5 Q. Testing performed by
6 nonparties at J&J's direction?

7 A. Yes.

8 Q. And the sampling and
9 protocols relating to the sampling of
10 those products, correct?

11 A. Yes.

12 Q. Now, you have been
13 designated as the person most qualified
14 to address those issues, correct?

15 A. That is my understanding,
16 yes.

17 Q. Okay. Why are you the one
18 most qualified?

19 A. I have a lot of experience
20 with Johnson & Johnson. I joined the
21 company in 1976. And was involved in
22 many aspects of what we've been talking
23 about for many, many years.

24 Q. And what did you do to

1 prepare for today's deposition?

2 A. I've read a significant
3 amount of documentation in the past week
4 and in the previous week.

5 In addition to that, I have
6 been involved in other litigation issues,
7 and I have read documentation for those
8 litigation issues in addition.

9 Q. What specifically did you
10 review in preparation for this
11 deposition?

12 A. I believe I've read pretty
13 well all of the documentation that would
14 support being able to give an answer to
15 each of those topics that you raised in
16 the last few minutes.

17 Q. Okay. And is there a
18 compendium of documents, a book of
19 documents that you looked at?

20 A. I understand that all of the
21 documents that I've read are being
22 submitted to the court and have already
23 been made available to the court.

24 Q. No, I understand that. But

1 are the documents all gathered in one
2 place that you've taken a look at?

3 A. Yes.

4 Q. And where are they?

5 A. I don't have them. The
6 attorneys will have those.

7 Q. Were they in a book, a
8 binder?

9 A. A book -- a binder.

10 Q. And what was it labeled?

11 A. It was labeled with this --
12 with this heading for this litigation,
13 this deposition.

14 Q. Okay.

15 MR. BICKS: Counsel, I
16 think -- and you can tell me if I
17 have this wrong, the collection
18 and compendium of documents are
19 typically viewed as work product.

20 It's my understanding in
21 this court, and if I have an
22 incorrect understanding, I'd like
23 you to -- I'm happy to discuss
24 that with you. But that's my

1 typical understanding. I can tell
2 you that you're aware of all the
3 documents and you have them.

4 BY MR. PLACITELLA:

5 Q. Okay. How many binders were
6 there?

7 A. Four.

8 Q. All right. Who did you
9 speak with, other than counsel in order
10 to prepare for today's deposition?

11 A. No one other than counsel
12 for this deposition.

13 Q. Having had the opportunity
14 to review the documents that you thought
15 were important, what questions remain
16 unanswered in your mind that are the
17 subject of the notice of this deposition?

18 MR. BICKS: No foundation.
19 Go ahead.

20 THE WITNESS: I wasn't aware
21 there were new documents that I
22 had not seen before. And I was
23 not aware of any issues that
24 have -- that remained unanswered.

1 BY MR. PLACITELLA:

2 Q. Okay. Now, you understand
3 that we're here to find out what
4 information Johnson & Johnson has or had
5 relevant to the topics of this
6 deposition, correct?

7 A. That's my understanding,
8 yes.

9 Q. We would -- in this
10 deposition we'll be asking for -- we'd
11 want to know what the source of the
12 information is, correct?

13 A. Yes.

14 Q. Okay. We would want to know
15 what specifically was related to Johnson
16 & Johnson or discussed by Johnson &
17 Johnson. Do you understand that?

18 A. I do. Yes.

19 Q. Okay. And what we're
20 looking for here is what Johnson &
21 Johnson knew or was advised of and
22 whether you're aware of information that
23 supports that contemporaneously with
24 those advices.

1 Do you understand that?

2 A. I do, yes.

3 Q. Do you understand that
4 you're not here as an expert witness,
5 correct?

6 A. I do understand that, yes.

7 Q. We're not looking for any
8 opinions from you.

9 Do you understand that?

10 A. I understand that, yes.

11 Q. Okay. We're not asking you
12 to interpret the information that we're
13 here to find out in terms of what was
14 related to or discussed at Johnson &
15 Johnson.

16 Do you understand that?

17 A. I do, yes.

18 Q. Do you understand that we're
19 not here to debate the science and the
20 methodology of the testing that's
21 discussed, correct?

22 A. Correct. Yes.

23 Q. Okay. We're not here to
24 debate -- so I just want to make sure

1 we're all on the same page.

2 What we're here to find out
3 is what Johnson & Johnson knew and what
4 information you had that
5 contemporaneously supports that
6 information.

7 You got that?

8 A. Okay.

9 MR. BICKS: Counsel, I only
10 object in the sense that it's a
11 30(b)(6) deposition, and you
12 recited all the categories that
13 we're here to talk about.

14 BY MR. PLACITELLA:

15 Q. Okay. Now, you've testified
16 before in litigation involving Johnson &
17 Johnson talc and injuries related to that
18 talc, correct?

19 A. Correct, yes.

20 Q. How many times?

21 A. In the past year including
22 deposition and trial witness, this would
23 be number eight.

24 Q. And how many trials? Am

1 I -- am I correct that it's three at this
2 point?

3 A. This year?

4 Q. Yes.

5 A. Yes.

6 Q. And have you covered in
7 those trials and the other depositions
8 any -- well, strike that.

9 Is any of the topics that --
10 MR. PLACITELLA: God bless
11 you.

12 BY MR. PLACITELLA:

13 Q. Any of the topics that you
14 were asked to address here today not
15 covered in your prior testimony?

16 MR. BICKS: Objection to the
17 form.

18 THE WITNESS: Yeah, it
19 depends on how we interpret what
20 you'd like me to talk about today.
21 Certainly some of the questions
22 that may be asked in previous
23 testimony may be phrased
24 differently. But substantially,

1 we're talking about information
2 held in Johnson & Johnson's files.

3 BY MR. PLACITELLA:

4 Q. Okay. You understand that
5 in testifying today, your testimony will
6 bind Johnson & Johnson, correct?

7 A. I understand that, yes.

8 Q. You're like all the
9 executives at Johnson & Johnson rolled
10 into one?

11 A. How nice.

12 Q. Okay. Now, you're currently
13 a resident of Great Britain?

14 A. That is correct, yes.

15 Q. Okay. And you have never
16 been a U.S. citizen, correct?

17 A. No.

18 Q. Do you have a bachelor of
19 chemistry and biochemistry from the
20 University of Saint Andrews in Scotland?

21 A. I do, yes.

22 Q. And am I correct that you
23 started with Johnson & Johnson in the UK
24 in 1976?

1 A. I did, yes.

2 Q. And you kept that position
3 until 1994?

4 A. Yes.

5 Q. And during that time, you
6 worked in the medical department?

7 A. Yes.

8 Q. You worked in safety and
9 toxicology?

10 A. Yes, I did. Yes.

11 Q. And you were head of R&D in
12 the UK for Johnson & Johnson?

13 A. Up until '94, yes. End of
14 '94, yes.

15 Q. And in 1995 you came to the
16 United States?

17 A. I did, yes.

18 Q. And after you relocated to
19 the United States, you continued to work
20 for Johnson & Johnson?

21 A. Yes, yes. I was based in
22 the United States.

23 Q. Okay. And when you came to
24 the United States, you were responsible

1 for R&D for baby products worldwide; is
2 that fair?

3 A. That is correct, yes.

4 Q. And you left Johnson &
5 Johnson in 1998?

6 A. No. At the end of 1998, I
7 left the United States --

8 Q. Okay.

9 A. -- and I moved to Johnson &
10 Johnson France for 1999 until April, May
11 2000.

12 Q. Okay. And at that point in
13 time, you left the formal employ of
14 Johnson & Johnson?

15 A. In April, May 2000. Yes.

16 Q. Now, after 2000 you remained
17 as a consultant to Johnson & Johnson
18 until approximately 2011?

19 A. I didn't think it was as
20 late as 2011. I think it was more like
21 2007, '8 I did some consulting work for
22 the European countries, yes.

23 Q. So your consulting work for
24 Johnson & Johnson terminated in 2008?

1 A. Approximately, yes. As I
2 recollect, yes.

3 Q. During what period of time
4 did you work for Johnson & Johnson as a
5 litigation consultant concerning talc?

6 A. I did -- it was a trial in
7 South Dakota in 2012. That was -- that
8 was one I did there. And then there have
9 been several since then.

10 Q. Am I correct that you worked
11 on litigation related to talc from 19 --
12 for Johnson & Johnson from 1995 all the
13 way to the present?

14 A. I have -- if I've been asked
15 for an opinion, a litigation opinion,
16 I've endeavored to provide that opinion,
17 yes.

18 Q. Okay. Now, you are not a
19 geologist, correct?

20 A. That is correct.

21 Q. You are not a microscopist.
22 You know what I mean by microscopist?

23 A. Yes, I do.

24 Q. What do I -- what is your

1 understanding?

2 A. Someone who has hands-on
3 experience day after day with a
4 microscope.

5 Q. And you've never looked at,
6 under a microscope, for -- at Johnson &
7 Johnson talc for contaminants, correct?

8 A. Personally, no, I've not.

9 Q. Okay. One of the topics
10 that you're here to talk about are the
11 formulas as they relate to the Johnson &
12 Johnson baby power -- Baby Powder and
13 Shower to Shower products, correct?

14 A. Yes.

15 Q. Okay. What's the difference
16 in your mind between a formula and a
17 specification as it relates to Johnson &
18 Johnson?

19 A. Okay. A formula describes
20 the components that go into a product.
21 So if you take Johnson's Baby Powder,
22 it's over 99 percent talc, and a little
23 bit of fragrance. So that's the formula,
24 just two components.

1 Some formulas in some
2 products would have three or four
3 different ingredients. There may be
4 cornstarch, baking soda, fragrance, et
5 cetera.

6 Specification describes the
7 properties of a product. What it looks
8 like, smells like, feels like, are there
9 any microbes present. It could measure
10 the properties such as any trace
11 elements. So the specification lists
12 those points and sets a limit as to what
13 that quality of those products are. So
14 the two are quite different.

15 Q. And is it your understanding
16 now that Johnson & Johnson no longer
17 claims that the formulas for its Baby
18 Powder products or its products related
19 to Baby Powder are confidential?

20 A. I have not seen any
21 documentation to say that they are or are
22 not. Like I said, they are pretty simple
23 products.

24 Q. Are you aware that you now

1 have on your website the declaration that
2 the formulas for the baby -- the products
3 from the Baby Powder company are no
4 longer considered confidential?

5 A. I wasn't aware of that, but
6 I'll accept that.

7 Q. We'll find it later and make
8 sure we're all on the same page.

9 Now, are the formulas for
10 the Johnson & Johnson Baby Powder and
11 Shower to Shower patented?

12 A. No.

13 Q. Okay. And where are the
14 actual formulas stored? Are there
15 formula cards for these products?

16 A. The formula is part of a
17 manufacturing process. If you have -- if
18 you're going to manufacture Baby Powder,
19 the people manufacturing it will have the
20 formulation, and they -- they're give
21 that information. So it will be in the
22 manufacturing facility. Obviously there
23 will also be copies in the research
24 facility.

1 Q. Okay. Have you actually
2 seen -- is it a formula card, is it --
3 what is it?

4 A. I'm sure these days it's
5 electronic.

6 Q. Okay.

7 A. But there is a formula --
8 all products, whether it's baby lotion,
9 baby shampoo, they all have a formula.
10 And that formula is disclosed to the
11 manufacturing facility. And copies are
12 held within the research facility in a
13 file. Basically there's a file for baby
14 shampoo, file for baby bath, file for
15 Baby Powder. So that file will hold the
16 formula.

17 Q. And have you reviewed the
18 current formula for Baby Powder?

19 A. I've seen the current
20 formula. Yes.

21 Q. And have you reviewed the
22 historical formulas for Baby Powder?

23 A. I've -- I've seen a broad
24 overview of the historical formulas.

1 They have varied slightly over the years
2 with -- back in the 1920s, '30s, there
3 were -- various additives were included
4 and then excluded.

5 Q. And is that all in one
6 place, all in one file, the historical
7 formulas for Baby Powder?

8 A. I don't have the answer to
9 that question. But certainly within the
10 company, there's -- there's a history of
11 formulations for Baby Powder, yes. I
12 don't have that with me.

13 Q. So who would I go to, if not
14 you, if I wanted to see all of the
15 historical formulas for Baby Powder?

16 A. My advice would be to talk
17 to the current research facility who
18 would have at least an element of that,
19 and should have as much as possible.

20 Q. And who would that person
21 be, the person in charge?

22 A. It would be the research
23 manager of the baby products area.

24 Q. And who is that?

1 A. I don't know his or her name
2 today.

3 Q. Okay. And does the same
4 go -- is the same true for the Shower to
5 Shower product?

6 A. Well, the Shower to Shower
7 brand was sold by the company a few years
8 back. So my understanding would be that
9 the formulas and the information would
10 have gone to the new owner of that
11 business. So I don't know whether that
12 information is still available in
13 Johnson & Johnson.

14 Q. So you don't know whether
15 Johnson & Johnson maintains somewhere a
16 historical file all the formulas for
17 Shower to Shower that it sold?

18 A. I don't -- I don't know
19 where they are, is what I'm saying, is
20 there was a file for the formula of
21 Shower to Shower. There's no reason to
22 suspect that it's not available today.
23 It's a pretty simple product. But it has
24 changed over the years. Initially it was

1 just talc and fragrance. And then it was
2 blended out with cornstarch and also
3 baking soda.

4 Q. Okay. And who would be the
5 person we would ask the question to,
6 where is that stuff?

7 A. That information would be
8 held within the research facility at
9 Johnson & Johnson.

10 Q. Okay. Included in the
11 formula for Baby Powder and Shower to
12 Shower, is it my understanding that there
13 are fragrances?

14 A. Yes.

15 Q. Okay. And are you aware
16 specifically of the chemical composition
17 of the fragrances historically for
18 these -- both of these products?

19 A. That's -- a typical
20 fragrance comprises about 100 or even
21 slightly more different ingredients.
22 They're mostly obtained from botanical
23 extracts, flower extracts, et cetera.

24 That information is held in

1 confidence by the fragrance supplier.
2 That's not usually disclosed to Johnson &
3 Johnson. The information is given to us,
4 this is fragrance P, whatever it may be.
5 It's given a reference ID, and that
6 information is held in confidence by the
7 supplier of the fragrance.

8 Q. So who was the supplier of
9 the fragrances, to your knowledge, that
10 were used in Johnson & Johnson Baby
11 Powder historically?

12 A. The suppliers over the years
13 have changed because they were usually
14 bought out by other major suppliers.

15 I believe, I'm not sure who
16 the current owner is. But it --
17 certainly at one time it was a company
18 called Belmay.

19 Q. But --

20 A. Belmay, B-E-L-M-A-Y. But I
21 think they were bought out by other
22 companies over the years. And that
23 company was also bought out. So I'm not
24 sure who the current supplier's name is.

1 Q. Well, if we wanted to find
2 out who the supplier of the fragrances
3 were for the Johnson & Johnson Baby
4 Powder and the Shower to Shower product
5 historically, how would we find that out?

6 A. Again --

7 Q. Who would we ask?

8 A. Again, same answer. The
9 research facility would be expected to
10 have that information. Okay. You'd have
11 to go -- we'd have to go back to the
12 specification and details back to many,
13 many years. But that information should
14 be held on file.

15 Q. All right. So what would I
16 ask for specifically, so when we go back
17 and do it, we don't make people do
18 unnecessary work?

19 A. Well, what would you like to
20 know?

21 Q. We would like to know who
22 the suppliers were of the fragrances that
23 were used in Johnson & Johnson Baby
24 Powder and Shower to Shower historically,

1 say from 1960 forward.

2 A. Okay. That -- simply just,
3 I would say, ask that question. Who are
4 the suppliers or who were the suppliers
5 of the fragrances used in Baby Powder,
6 Shower to Shower from that period -- time
7 period forward.

8 Q. Okay. But I thought you
9 were the guy that I was supposed to ask
10 that question to.

11 A. What I said to you was
12 that's not information I hold in my head.
13 I did give the name of one of the
14 suppliers of fragrance that I recollect.

15 But I'm also aware that, as
16 with many industries, our fragrance
17 suppliers are being bought by other
18 fragrance company, and another company
19 has bought them. So I'm not quite sure
20 who is the current name of the
21 fragrance -- the fragrance -- same
22 fragrance generally, but from a different
23 owner.

24 Q. Will you be able to make a

1 phone call or something overnight and get
2 that information, because you were the
3 guy that was supposed to bring it.

4 MR. BICKS: Can I -- just as
5 a matter of edification for me, I
6 gather there was some chart that
7 was under discussion or am I
8 mixing something up?

9 MR. PLACITELLA: You guys
10 were supposed to bring a chart.

11 MR. BICKS: And that was
12 supposed to be here today?

13 MR. PLACITELLA: That was my
14 understanding.

15 MR. BICKS: I didn't know
16 the timing.

17 MS. MALIK: I think that was
18 already produced.

19 MR. BICKS: I'll check on
20 the chart. I don't --

21 MR. PLACITELLA: I mean, I
22 don't want to belabor it. We can
23 come back to it tomorrow.

24 MR. BICKS: Right.

1 MR. PLACITELLA: But I
2 thought he was here to tell us who
3 the suppliers of the fragrances
4 were.

5 THE WITNESS: I've given you
6 one name. But like I say, the
7 fragrance suppliers tend to be
8 bought out by other larger
9 companies over the years.

10 BY MR. PLACITELLA:

11 Q. I know, but you don't
12 actually know who to ask. I was supposed
13 to ask you. There's supposed to be a
14 chart. I'm kind of lost.

15 A. I know. What --

16 Q. Give me some guidance.

17 A. What I'm saying is that
18 we'll ask the attorneys if they will ask
19 the R&D folks for that information.

20 Q. Okay. Now, you indicated
21 that the actual chemical formula of the
22 fragrances was something that was never
23 disclosed to Johnson & Johnson. Is that
24 a fair statement?

1 A. That's a fair statement.

2 And that's -- that applies to any
3 product, whether it's an adult shampoo or
4 an adult body wash. The fragrance is
5 proprietary information to the fragrance
6 company.

7 Q. But you said that that could
8 be made up of up to how many chemicals?

9 A. Typically, a good fragrance
10 is typically 100 or more different
11 ingredients.

12 Q. Well, who tests the
13 fragrance to make sure it's safe to use
14 on people?

15 A. People, okay. Simple answer
16 there is that there are two aspects of
17 that. One, the fragrance company, and
18 there are about 3,000 different
19 ingredients that fragrance companies can
20 use to create a fragrance. That's why,
21 you know, your aftershave smells
22 different than your wife's cologne. They
23 use different ingredients.

24 The testing is done based on

1 an approved list of about 3,000
2 ingredients. And that list of approved
3 ingredients is from a group called the
4 International Fragrance Research
5 Association, IFRA. And they set
6 standards. They set a limit as to what
7 can be used, where it can be used. They
8 have different categories for fragrance
9 that are used on the face, the body,
10 rinse-off products. And so a fragrance
11 house or fragrance company can create a
12 fragrance that meets that standard.

13 Then once the product is
14 received by a company like Johnson &
15 Johnson, Johnson & Johnson would then do
16 additional studies. You'd look at
17 checking that the fragrance didn't cause
18 skin irritation, skin sensitization,
19 allergy studies. So they'd be done on
20 the fragrance in the product.

21 Q. So I just want to be clear.
22 Johnson & Johnson puts into its products
23 chemicals that it has no idea what the
24 chemical composition is?

1 A. That's not entirely true.

2 The fragrance is tested by the fragrance
3 house and Johnson & Johnson.

4 I said that there is a list
5 of 3,000 -- approximately 3,000
6 ingredients that are -- we're fully aware
7 of the safety of those ingredients.
8 They've been evaluated in extensive
9 clinical studies, animal studies, to
10 ensure that they are safe and they meet
11 all the legal requirements by the
12 international fragrance research
13 association, IFRA.

14 So we know what the 3,000
15 are. We can -- we can look at that list.
16 That list is available from the
17 International Fragrance Research
18 Association.

19 Q. But you put in the product
20 specifically a group of chemicals, and
21 you do not know what those chemicals are
22 specifically, correct?

23 A. I'm not aware that the
24 company has ever broken down the

1 constituents of that 100, or whatever it
2 may be, different ingredients. As I say,
3 the majority are created from flower
4 extracts, botanical extracts. And that's
5 well established as to what they are.
6 They're natural materials.

7 And they're the same type of
8 ingredients that go into the shampoos and
9 body washes that we all in this room use
10 every day, underarm deodorants or
11 colognes. They're all the same kind of
12 ingredients used in different ratios to
13 get a different fragrance.

14 Q. Well, are the testing for
15 the fragrances done one at a time or in
16 combination? How is it tested?

17 A. The testing is done on each
18 of the ingredients one at a time, as you
19 say.

20 So for example, if there
21 were a lemon extract, that's being tested
22 in extensive studies in humans, animal
23 studies, patch tests, photology studies.
24 So those are one at a time, yes.

1 Q. But you don't know what --
2 if they're never tested when you put one
3 chemical with the other, they don't test
4 to see what the interaction is between
5 the chemicals?

6 A. No, you -- let's go back a
7 step. When a fragrance house creates a
8 fragrance with a blend of maybe 100
9 different ingredients, that fragrance
10 house formulates their product in a way
11 that is specified by the International
12 Fragrance Research Association to ensure
13 that the product is safe. They are the
14 experts in safety -- creating safe
15 products.

16 Q. So Johnson & Johnson Baby
17 Powder, is there lemon extract in there?

18 A. Not in the Baby Powder. I'm
19 pretty sure there is not in the Baby
20 Powder. I just used that as an example.

21 Q. Is there -- so what
22 chemicals are in the fragrances that are
23 in the Baby Powder?

24 A. There are extracts of

1 certain flowers that -- like lavender,
2 for example, one way you could -- if
3 you've got a lavender fragrance, you
4 might have a little bit of lavender
5 extract. There could be extracts of
6 other botanical plants.

7 Q. So you gave me lavender.
8 What's the other 99?

9 A. As I said, that is
10 confidential with the fragrance company.
11 That is, the only way we find that out is
12 to -- two things: One, in theory, I
13 suppose is that you could break it down
14 and get an understanding of that from
15 very sophisticated studies; or you would
16 have to get that from the fragrance
17 company.

18 But it's not something that
19 Johnson & Johnson holds. The fragrance
20 company supplies the fragrance that meets
21 the regulatory guidelines for a safe
22 fragrance.

23 Q. When they -- when you say
24 "safe fragrance," have they tested it for

1 carcinogenicity on an long-term basis
2 with an appropriate latency period, all
3 100 chemicals that go into the fragrance?

4 A. The fragrance, as I said --
5 I'll go back again. The fragrance
6 ingredients, there are 3,000 that are
7 approved. That approval is based on the
8 safety of each of ingredients. That will
9 include extensive testing for allergy,
10 irritation, systemic testing.

11 There's a phenomenal amount
12 of work that goes on within the fragrance
13 industry to ensure that the products are
14 safe.

15 Q. Okay. What was my question?

16 A. You asked had they tested
17 for carcinogenicity.

18 Q. All right. And what's the
19 answer?

20 A. And I said, well, that is
21 something that the fragrance companies
22 would have tested to their own protocols.
23 And I don't know what tests they've done
24 for each and every 3,000 ingredients.

1 But their approval is based on their
2 toxicologists stating they are safe based
3 on the data that they have.

4 Q. So you don't know as you sit
5 here today -- you cannot testify under
6 oath that the chemicals that are used in
7 the fragrances used in the Baby Powder
8 and Johnson & Johnson Shower to Shower
9 were tested for carcinogenicity? You
10 can't testify to that under oath,
11 correct?

12 A. Correct.

13 Q. Okay. Now -- and does the
14 consumer know that Johnson & Johnson has
15 no idea what chemicals it's putting in
16 its Baby Powder in order to make them
17 just smell good?

18 MR. SILVER: Objection to
19 form.

20 MR. BICKS: Argumentative.

21 BY MR. PLACITELLA:

22 Q. Do you have information from
23 anything that you've looked at to
24 indicate that the consumer has ever been

1 advised that Johnson & Johnson has no
2 idea what specific chemicals are being
3 put into the Baby Powder or Shower to
4 Shower to make them smell good?

5 MR. SILVER: Object to the
6 form.

7 MR. BICKS: Object to the
8 form.

9 THE WITNESS: I'd refute the
10 point to say that they have no
11 idea.

12 The understanding I have is
13 that with a typical fragrance, you
14 have what's called a certain note,
15 a woody note or a floral note, et
16 cetera.

17 And certainly the fragrance
18 houses will tell you some of the
19 main ingredients that give you
20 that particular note, that
21 particular -- for example, there's
22 a chemical found in a number of
23 floral extracts, called Hedione or
24 Hedione, H-E-D-I-O-N-E. And I

1 know that's in -- certainly in
2 some of Johnson's baby products,
3 is a part of the fragrance.

4 So we're aware that there
5 are certain fragrance which are in
6 the formula. I don't know every
7 one of the 100 and whatever it may
8 be.

9 But certainly we're aware of
10 the type of fragrance note that
11 gives you the baby-type smell.

12 BY MR. PLACITELLA:

13 Q. Well, assuming -- and --
14 well, I'll get to it later so we don't
15 have to hold things up.

16 MR. PLACITELLA: Can you
17 give me Exhibit 69.

18 (Document marked for
19 identification as Exhibit
20 J&J-69.)

21 BY MR. PLACITELLA:

22 Q. I'll give you what's been
23 marked Exhibit 69.

24 (Whereupon, a discussion was

1 held off the record.)

2 THE VIDEOGRAPHER: The time
3 is 10:15 a.m. We are going off
4 the record.

5 (Short break.)

6 MR. SILVER: During the
7 break, two more individuals that
8 are not counsel have entered the
9 room. I'd like their names put on
10 the record for their appearance.

11 DR. EGILMAN: Triet Tram and
12 Alicia Rocha.

13 MR. SILVER: And I need a
14 representation of who these
15 individuals are.

16 MS. PARFITT: I understand
17 that they are research assistants
18 for Dr. Egilman.

19 MR. SILVER: Imerys'
20 objection is continuing and
21 ongoing as to the presence of
22 these two individuals. Again,
23 it's J&J's dep. So we're not
24 going to -- to let it go on. But

1 again, we believe it's a
2 continuing violation of CMO 11 in
3 that we believe that the PSC needs
4 our consent for it to go forward.

5 That being said, do I have a
6 representation from the PSC that,
7 if they have not at the moment,
8 they are going to sign the
9 confidentiality order?

10 MS. PARFITT: My
11 understanding is they are signing
12 it momentarily. We're having to
13 print it out.

14 MR. PLACITELLA: I'm not
15 going to let them sit here until
16 they sign it.

17 MR. SILVER: If they are
18 going to sign it, I'm not
19 really --

20 MR. PLACITELLA: I
21 understand your point. I
22 understand your point.

23 MR. SILVER: With that,
24 Imerys has made its record.

1 MR. LOCKE: PCPC joins in
2 Imerys's objection.

3 THE VIDEOGRAPHER: The time
4 is 10:20 a.m. Back on the record.

5 BY MR. PLACITELLA:

6 Q. All right. You have in
7 front of you Exhibit 69, which I put up
8 on the screen so everybody can see it.

9 It is the Johnson & Johnson
10 Baby Powder Formula Number 499, Fact Book
11 Supplement dated July 1974.

12 Do you see that?

13 A. I do, yes.

14 Q. And you've seen this before,
15 correct?

16 A. Yes.

17 Q. What is a fact book as it
18 relates to a formula, to your knowledge?

19 A. Well, the fact book, there
20 are many different kinds of fact book.
21 As this -- it relates to this one,
22 relates to -- this is a supplement to the
23 main fact book. The fact book itself is
24 a story of formula. It's how it's

1 developed, research, testing. It would
2 probably include safety testing, et
3 cetera. So all that gets put into a fact
4 book, so it's all available in one place
5 at one time.

6 This is a supplement
7 relating to a project which, as I read
8 this, is a process to clean the talc via
9 flotation.

10 Q. Okay. So when I did a
11 search of the database, I'm not saying
12 that I'm the best at this, but I didn't
13 see the original fact book. Have you
14 ever seen the fact book for Formula 499
15 which is the -- for Johnson Baby Powder?

16 MR. BICKS: Objection to the
17 form.

18 THE WITNESS: No, I've not
19 particularly seen the original
20 fact book. This is a supplement
21 to the fact book.

22 BY MR. PLACITELLA:

23 Q. Right. So there must be
24 something that came before it, correct?

1 A. Well, that's speculation.
2 But it's likely, yes.

3 Q. Okay. So it's likely
4 speculation?

5 A. Yes.

6 Q. So in preparation for in
7 your deposition and all the times that
8 you've ever testified, you've never seen
9 the actual fact book related to the
10 formulas for the Baby Powder?

11 MR. BICKS: Foundation.

12 THE WITNESS: No, that's not
13 true. I've seen fact books for
14 Baby Powder. You asked me about
15 this one with a reference to
16 Formula 499. But like I say, I
17 couldn't put my finger on 499.
18 But there is certainly a fact book
19 for Johnson's Baby Powder.

20 BY MR. PLACITELLA:

21 Q. And you've seen that?

22 A. I have seen that when I was
23 based here in New -- in New Jersey.

24 Q. So when is the last time

1 that you saw that fact book?

2 A. When I was based in New
3 Jersey in 1998.

4 MR. PLACITELLA: Now, this
5 fact book supplement, to the
6 extent that it has not been
7 produced, and I haven't seen it, I
8 would make a request for the fact
9 book that's been identified by the
10 witness.

11 BY MR. PLACITELLA:

12 Q. This is for Formula 499,
13 correct?

14 A. Yes.

15 Q. How many different formulas
16 was there for Johnson's Baby Powder? I
17 thought 499 was the formula number.

18 A. That was the designation in
19 1974. Yes. Yes.

20 Q. Okay. And had it changed
21 over time, the number?

22 A. I don't believe the formula
23 has changed since 1974. It's -- there
24 may have been very slight changes to the

1 perfume over the years. There can be
2 very slight changes. But it's
3 essentially a blend of over 99 percent
4 talc and a little bit of fragrance.

5 Q. But Formula 499 is the
6 formula designation for Johnson's Baby
7 Powder, correct?

8 A. It is in -- in this document
9 dated 1974, yes.

10 Q. Was it ever known by some
11 other number?

12 A. I don't have the answer to
13 that, because the product has been on the
14 market since 1920s. There have been a
15 Johnson's Baby Powder on the market since
16 the 1920s. And in some of those early
17 formulas, there were additional
18 ingredients back in the 1920s, boric
19 acid. There was a small amount of boric
20 acid.

21 There has also been at times
22 a small amount of a -- what's called a
23 free float agent to stop the talc from
24 clogging in the holes in the -- in the

1 bottle. Sodium sesquicarbonate which has
2 been used at some time or another. So
3 there have been minor changes. And when
4 you make a minor change, you give a
5 different formula reference.

6 Q. So the number changes?

7 A. The number would change,
8 yes.

9 Q. So where would I go to find
10 all the formula numbers for Baby Powder
11 or Shower to Shower and the fact books
12 related to those numbers?

13 MR. BICKS: No foundation.
14 Go ahead.

15 THE WITNESS: I can only say
16 that the first port of call to ask
17 the question -- whether they are
18 instantly available, I do not
19 know -- would be the research
20 group. And whether they go back
21 to 1926, I would speculate
22 possibly may -- may not.

23 BY MR. PLACITELLA:

24 Q. How far back do they go? Do

1 you know?

2 A. I don't know how far the
3 fact books go back, no.

4 Q. And is that something that
5 we can figure out today or tomorrow. Can
6 you make a phone call?

7 A. I don't have the answer to
8 that. I don't know.

9 Q. Okay. What is typically
10 included in a fact book as it relates to
11 the formulas for the products that we're
12 here to address?

13 MR. BICKS: No foundation.
14 Go ahead.

15 THE WITNESS: A typical fact
16 book would include the formula,
17 the percentages of each of the
18 ingredients. It would describe
19 what the ingredients were, where
20 they were sourced from, who the
21 supplier was, fragrance supplier,
22 et cetera.

23 It would describe at least
24 the basis of how products were

1 mixed together. It would describe
2 the specification or
3 specifications, color, appearance,
4 odor, the content of various
5 impurities, et cetera.

6 So those would all be listed
7 as part of the fact book. The
8 fact book would also give an
9 indication of any safety testing
10 on -- or clinical testing on the
11 finished formula.

12 And so that's -- that's all
13 part of the story of the product
14 that's put together into a fact
15 book.

16 BY MR. PLACITELLA:

17 Q. So if I wanted to know the
18 real story of the product, it would be
19 essential for me to see the fact book,
20 correct?

21 MR. BICKS: Objection to the
22 form.

23 THE WITNESS: The story of a
24 product is in the fact book.

1 MR. PLACITELLA: Okay. Can
2 you guys tell me, have you ever
3 produced the fact books for the
4 Johnson & Johnson Baby Powder or
5 Shower to Shower? I haven't seen
6 them. I'm not saying you haven't.
7 But I've done a pretty exhaustive
8 search. Can you tell me whether
9 you've ever produced them?

10 MR. BICKS: I can't speak to
11 the well over millions of pages of
12 documents that have been produced.

13 MR. PLACITELLA: Yeah, but
14 this is not some pages of
15 document. This is the
16 quintessential document that gives
17 the history of the product.

18 Can we, during a break,
19 figure out whether we were ever
20 given the fact books and if you
21 can produce them here.

22 MR. BICKS: We'll figure out
23 whether that's something that we
24 can do. But as you know, there's

1 masses of materials that you all
2 have, and combing through is a
3 very --

4 MR. PLACITELLA: If you
5 can -- if you can tell me what the
6 Bates number is for the fact book,
7 we'll go find it. But I spent a
8 couple hours searching through the
9 database, and I couldn't find it.

10 That doesn't mean that I'm
11 good at it. But I would --

12 What are you -- what are you
13 laughing at?

14 But that's something that I
15 think we need to get to. All
16 right.

17 BY MR. PLACITELLA:

18 Q. So let me ask you about this
19 supplement to the fact book.

20 If I go to the Bates Number
21 9324. I'll blow it up for you. It gives
22 me all of the people who are involved in
23 this supplement, correct?

24 A. Yes.

1 Q. Okay. And --

2 A. The people who are copied in
3 on it, yes.

4 Q. Right. And these are all
5 the top people involved in the testing
6 for the Johnson's Baby Powder in 1974, or
7 most of the top people?

8 A. They were key people in the
9 research department in 1974. Yes.

10 Q. Okay. And it says all these
11 people have copies -- got copies of this
12 fact book supplement.

13 Do you see that?

14 A. It does say that. Yes.

15 Q. And it also says that the
16 fact book supplement went to a central
17 file.

18 Do you see that?

19 A. That's what is written, yes.

20 Q. Where was that central file
21 kept?

22 A. In 1974, that was in New
23 Brunswick in the research department in
24 New Brunswick.

1 Q. Okay. The -- now, I notice
2 that, if you look down at the bottom,
3 this actually has an Imerys Bates stamp.
4 So it doesn't look like we got it from
5 you. So did you give the fact book to
6 your suppliers as well?

7 MR. BICKS: Did we what?

8 BY MR. PLACITELLA:

9 Q. When you put together the
10 fact book, did you distribute it to your
11 suppliers?

12 A. No. No. Imerys was not a
13 supplier in 1974.

14 Q. Do you have any idea how
15 Imerys got your fact book?

16 A. No.

17 Q. Okay. Now, in the fact book
18 supplement on 9327, there is a formula.

19 Do you see that? I put it
20 up on the screen.

21 A. Yes.

22 Q. It says, "Windsor" --
23 "Ingredients: Windsor 66 talc." And it
24 gives a percentage by weight.

1 Do you see that?

2 A. I see that, yes.

3 Q. And it also lists Synfleur
4 Perfume P.

5 Do you see that?

6 A. Yes, Perfume P. Yes.

7 Q. Okay. And who is the
8 supplier of Synfleur Perfume P, if you
9 know?

10 A. In 1974 it could have -- I
11 think there was a company called
12 Synfleur. Yes.

13 Q. Okay. And what went into
14 Synfleur Perfume P?

15 A. That's what we talked about
16 a few minutes ago. As I said, a typical
17 fragrance, and it's not radically changed
18 in many, many years, is a blend of a
19 significant number of extracts from
20 flowers, plant extracts, and they're put
21 together by the fragrance company to
22 create the fragrance that people
23 recognize as Johnson's Baby Powder
24 fragrance.

1 Q. So as you sit here today,
2 you cannot tell me, based upon records
3 that you've reviewed, what chemicals went
4 into Synfleur Perfume P in 1974, correct?

5 MR. BICKS: Objection. No
6 foundation.

7 THE WITNESS: No. As I said
8 a few minutes ago, that
9 information is held as
10 confidence -- in confidence by the
11 fragrance supplier.

12 BY MR. PLACITELLA:

13 Q. Okay. What testing did
14 Johnson & Johnson do in 1974 to make sure
15 that the chemicals in Synfleur Perfume P
16 could not cause cancer?

17 A. You don't have to do testing
18 to ensure that it won't cause cancer.
19 The fragrance supplier uses an approved
20 list of materials which have been shown
21 to be safe, both systemically and to the
22 skin, to the dermis, to avoid skin
23 irritation and sensitization and to avoid
24 chemicals that are regarded as likely to

1 cause cancer.

2 Q. So the answer to my -- I'll
3 ask the question a different -- a
4 different way.

5 Johnson & Johnson did not do
6 any testing in 1974 to determine whether
7 the chemicals used in Synfleur Perfume P
8 contained -- were carcinogenic, correct?

9 A. Johnson & Johnson did not,
10 no. That was the responsibility of the
11 fragrance supplier. And at that time
12 there were, and still are, tests that
13 will predict whether a material will
14 cause cancer. They're called
15 genotoxicity tests. And they are part of
16 the test program that are used by
17 fragrance suppliers when they're
18 evaluating raw materials.

19 Q. Johnson & Johnson did no
20 tests to determine whether the chemicals
21 that were part of the perfume from 1974
22 forward could cause cancer, correct?

23 A. Johnson & Johnson did not.
24 It was the responsibility of the

1 fragrance company to ensure that that
2 standard was met.

3 Q. But doesn't -- in terms of
4 safety, doesn't the buck stop with
5 Johnson & Johnson, Dr. Hopkins?

6 A. You're asking me to
7 speculate. And what I'm saying is that
8 as far as safety is concerned, the
9 fragrance house, the fragrance company,
10 has the responsibility to provide a safe
11 fragrance.

12 Q. I'm not asking you to
13 speculate. Doesn't the buck, in terms of
14 safety of the product that's being sold
15 by Johnson & Johnson, stop with Johnson &
16 Johnson?

17 MR. BICKS: Objection to the
18 form.

19 THE WITNESS: Again, it's an
20 odd question.

21 The responsibility for
22 safety is Johnson & Johnson's.
23 And they will achieve that role by
24 talking with the supplier and

1 ensuring that the supplier sends
2 or provides a fragrance that is
3 safe and suitable for its end use.

4 BY MR. PLACITELLA:

5 Q. Did Johnson & Johnson get
6 letters from -- or certifications from
7 its suppliers indicating that the
8 chemicals that were used in the perfumes
9 for its Baby Powders had passed
10 carcinogenic testing?

11 A. I don't know the answer to
12 that question.

13 Q. How would we find that out?

14 A. Again, I don't know how you
15 would find that out.

16 What I'm saying though,
17 again, is the fragrance company has the
18 role and responsibility to provide
19 fragrances that are safe. And that role
20 is handed to the fragrance company and
21 then they provide a fragrance that is
22 safe for its end use.

23 Q. So the safety of your
24 product is only as good as the fragrance

1 company that you select?

2 MR. BICKS: Objection to the
3 form.

4 THE WITNESS: Again, the
5 fragrance companies, they all
6 operate to a standard. The IFRA
7 standard, International Fragrance
8 Research Association standard.

9 And that standard requires
10 that for each of the ingredients
11 that are composed in a fragrance,
12 they meet certain safety
13 standards, minimum safety
14 standards to ensure that the
15 fragrance ingredient is not
16 harmful.

17 BY MR. PLACITELLA:

18 Q. Well, did you ever visit the
19 laboratories of the fragrance companies
20 to see that they were actually doing the
21 testing correctly?

22 A. I personally have not
23 visited the labs of the fragrance
24 companies.

1 Q. What about Johnson &
2 Johnson, did they do any due diligence to
3 make sure that the fragrance companies
4 were conducting the appropriate testing
5 or did they just take their word for it,
6 that they were testing whatever they were
7 supposed to test?

8 A. You're using the word
9 testing. Let me be clear. It is not
10 normal to test each and every fragrance
11 every time.

12 If you are operating from a
13 palate of say 3,000 ingredients, those
14 ingredients have already been evaluated
15 by the International Fragrance Research
16 Association, IFRA, to ensure that they
17 are safe. The fragrance company can then
18 use those ingredients to the permitted
19 amounts to create a safe fragrance. You
20 don't need to test them again. They've
21 already been tested.

22 Q. And IFRA is a trade group?

23 A. IFRA is a trade group. And
24 it takes its information from RIFM,

1 R-I-F-M, which is the Research Institute
2 For Fragrance Materials. And that group
3 is supported by the fragrance industry.

4 And they spend millions
5 every year to do safety testing on each
6 of those ingredients.

7 Q. Is Johnson & Johnson part of
8 that trade group?

9 A. To my knowledge it's not
10 part of RIFM, no. It's a fragrance
11 companies group.

12 Q. So Johnson & Johnson relies
13 upon the supplier who they can't identify
14 as they sit here today who relies upon a
15 trade group that Johnson & Johnson is not
16 a part of, and that's how they know the
17 products that are used and their products
18 are safe. That's what you're saying?

19 MR. BICKS: Objection to the
20 form.

21 THE WITNESS: I think you
22 are misconstruing and
23 misrepresenting. I'm going to say
24 it again, if I may, is that the --

1 each of those ingredients that go
2 in to make a fragrance has been
3 independently evaluated by the
4 Research Institute on Fragrance
5 Materials. And they will approve
6 the use of each of those fragrance
7 ingredients to be used by a
8 fragrance manufacturing company to
9 create a fragrance that is safe.

10 BY MR. PLACITELLA:

11 Q. In the formula, you don't
12 seem -- you don't list anywhere particle
13 size. Is that listed somewhere else in
14 the fact book?

15 A. Particle size of what? The
16 talc?

17 Q. Yes.

18 A. The specification for the
19 talc would include what's called a mesh
20 size. I need to look at this book again.
21 Mesh size relates to the ability of the
22 talc to pass through a certain mesh. And
23 that limits the size.

24 Q. Okay. So the size of the

1 particles is not part of the formula.

2 That's something that goes in a
3 specification? Is that your testimony?

4 A. It's part of the
5 specification for the talc, the raw
6 material talc, yes.

7 Q. Now, in this, under the name
8 Johnson & Johnson -- Johnson's Baby
9 Powder, you have an asterisk. Do you
10 know what that asterisk is for?

11 A. Yes. It's something the
12 company -- the corporation uses, and has
13 done right up until today. It just
14 indicates that it's trademarked. It
15 means that other companies cannot use the
16 word Johnson's, if it's got the asterisk
17 there. It's trademarked.

18 (Document marked for
19 identification as Exhibit
20 J&J-207.)

21 BY MR. PLACITELLA:

22 Q. I'm going to show you what's
23 been marked 207.

24 MR. SILVER: Do you have

1 copies?

2 MR. PLACITELLA: No. But

3 I'll put it up.

4 BY MR. PLACITELLA:

5 Q. You've seen 207 before?

6 A. Yes.

7 Q. What is it?

8 A. It's a document describing
9 the process specification for a new
10 Shower to Shower medicated formula. It's
11 a variant on Shower to Shower. It's
12 dated '94, '95.

13 Q. And if you go to the Bates
14 Number 57835, which I put up on the
15 screen, it lists the quantitative
16 formula.

17 Do you see that?

18 A. Yes, I do see that. Yes.

19 MR. SILVER: Since there's
20 no copies, can you -- and pursuant
21 to the protocol, just read into
22 the record the first Bates number
23 on the first page?

24 MR. PLACITELLA: Sure. The

1 first Bates number would be 833.

2 MR. SILVER: Can you read
3 the full one in just -- into the
4 record, or I'll do it. JNJ --

5 MR. PLACITELLA:

6 JNJ000057834.

7 MR. SILVER: Thank you.

8 BY MR. PLACITELLA:

9 Q. Okay. So this lists the
10 ingredients for Shower to Shower?

11 A. It lists the ingredients for
12 Shower to Shower Formula 2118-114.

13 Q. Did that formula ever change
14 to your knowledge?

15 A. It has changed over the
16 years, yes.

17 Q. Okay. And was there a fact
18 book for the Shower to Shower formula as
19 well, similar to the Baby Powder?

20 A. That is my understanding,
21 yes.

22 MR. PLACITELLA: Again, I
23 make the request for the fact
24 books related to the Shower to

1 Shower.

2 BY MR. PLACITELLA:

3 Q. It lists here in Item Number
4 5, Fragrance Creation L94-173.

5 Do you see that?

6 A. Yes, I do.

7 Q. Who is the supplier for
8 fragrance creation L94-173?

9 A. I think the name gives it
10 away. I believe Creation Aromatique,
11 which is a fragrance company.

12 Q. Okay. And they are located
13 where?

14 A. They have a U.S. office.
15 I'm not sure where it is.

16 Q. And for how long or during
17 what period of time were they the
18 supplier of the fragrance for Shower to
19 Shower, if you know?

20 A. I don't know.

21 Q. Okay. Would all this
22 information be in the fact book?

23 A. I would expect it to be.

24 Q. Okay. Now, and if I asked

1 you all the same questions here about the
2 fragrance that I asked you about the Baby
3 Powder, your answers would be the same?

4 A. Yes.

5 Q. Okay. I'm going to change
6 gears now. I want to talk to you about
7 the supply of the talc for use in the
8 Johnson & Johnson's Baby Powder and
9 Shower to Shower. Okay?

10 A. Yes.

11 Q. Okay. Now, as a compliment
12 to Mr. Bicks, I put up his slide from a
13 recent trial.

14 Have you ever seen this
15 slide before?

16 A. Yes.

17 Q. And do you see the slide is
18 entitled "Cosmetic Talc Mining Sources
19 For Johnson & Johnson"?

20 Do you see that?

21 A. Yes.

22 Q. And listed are three
23 sources: Windsor, Vermont --

24 I have a copy if you want

1 it.

2 MR. PLACITELLA: I marked it
3 at 158.

4 (Document marked for
5 identification as Exhibit
6 J&J-158.)

7 BY MR. PLACITELLA:

8 Q. 1964 to 2003.

9 Val Chisone, Italy, 1926 to
10 1973. And I'm not going to butcher the
11 name of China.

12 What's that town?

13 A. Guangxi.

14 Q. Thank you. China, 2003 to
15 the present, correct?

16 A. Yes.

17 Q. Now, that's a general
18 statement, correct, that there are
19 nuances to that supply, right?

20 A. Yes.

21 MR. PLACITELLA: Okay. So
22 can you give me 241.

23 (Document marked for
24 identification as Exhibit

1 J&J-241.)

2 BY MR. PLACITELLA:

3 Q. I'm going to show you --
4 Exhibit 241 is a set of interrogatory
5 answers from Johnson & Johnson in
6 Middlesex County.

7 Do you see that?

8 I'm going to go to one
9 specific answer, which is Answer Number
10 83, and I've tabbed it for you. And I've
11 put it up on the screen so we're all on
12 the same page.

13 A. Yes.

14 Q. In this interrogatory
15 answer, Johnson & Johnson provides what
16 it believes were the source, the specific
17 source of talc for Johnson's Baby Powder.
18 Do you see that?

19 A. Yes.

20 Q. And it gives the mine and
21 the supplier, correct?

22 A. It does, yes.

23 Q. Does this accurately
24 reflect -- accurately reflect what your

1 understanding is concerning the sources
2 from 1946 to 1992?

3 A. We're talking about the
4 table, are we?

5 Q. Yes.

6 A. Yes, I believe that is
7 correct. Yes.

8 Q. Okay. And then I'm just
9 going to go to the next page.

10 The next page lists the
11 sources from 1992 to the present,
12 correct?

13 A. It lists sources, yes. The
14 only comment that I would make is that my
15 understanding is that on the 2003-2009,
16 as far as the United States is concerned,
17 my understanding is that only the Zhizhua
18 quarry supplied to the United States.
19 Some of those other quarries are approved
20 by Luzenac and may be used -- may have
21 been used by other overseas J&J
22 affiliates. But my understanding is that
23 as far as the United States is concerned,
24 that 2003 issue is the Zhizhua quarry.

1 Q. I'm going to give you an A
2 for pronunciation no matter what happens
3 in this deposition.

4 The -- so --

5 MR. BICKS: I don't think
6 it's -- and you'll know, but I
7 think the time frames have been
8 divided up on some of these topics
9 with Mr. Hicks, I think, who
10 covered all the China.

11 MR. PLACITELLA: I'm not
12 going into -- 2006 is where I'm --
13 I'll stop for today.

14 BY MR. PLACITELLA:

15 Q. So let's just -- for the
16 record, because if someone is reading
17 this, they are not going to be able to
18 see the chart. So why don't you just go
19 through quickly what the chart reflects
20 in terms of time frame and supplier, for
21 the record?

22 MR. BICKS: You want him to
23 read the chart?

24 THE WITNESS: You want me to

1 read the chart?

2 BY MR. PLACITELLA:

3 Q. If you can.

4 A. 1946 to 1964, it was from
5 the Val Chisone mine in Italy, Italian
6 00000 grade. And supplier to the U.S.
7 agent was Charles Mathieu.

8 1964 to 1966, it was the
9 beginning of the Hammondsville, Vermont
10 mine and the supplier was Eastern
11 Magnesia Talc Company. And that was
12 running in parallel with the Italian Val
13 Chisone source as the new mine was being
14 phased in. So they were running two
15 together. Sometimes there's a blend.

16 By 1966 onwards to 1979, it
17 was the Hammondsville mine, again
18 supplied by Windsor Minerals, because
19 that was the new owner.

20 1976 to '79, again,
21 Hammondsville was supplying it to J&J by
22 Windsor Minerals.

23 In 1980 it was mostly
24 supplied by the Hammondsville mine,

1 Windsor Minerals. But because there was
2 a mine strike in the end of
3 December-January-February time period,
4 '79-'80, a small quantity of the Italian
5 talc was brought in to supplement the
6 stocks.

7 And then back in 1981 to
8 1988, it was the Hammondsville mine in
9 Vermont, supplied by Windsor Minerals.

10 1989 to 1990 it was the
11 Hammondsville mine. And the supplier
12 there is Cyprus Minerals, who took
13 ownership at that point. And they also
14 used the Argonaut and the Rainbow mine at
15 some point.

16 And likewise 1990 to 1992,
17 Cyprus Minerals, the Hammondsville mine,
18 the Argonaut and a little bit of Rainbow.
19 But because Hammondsville was pretty well
20 worked out, it was the introduction of
21 the Hamm mine in that time period.

22 And then turning over to
23 1992 to 2000, again Hammondsville,
24 Argonaut, Rainbow, and the Hamm mine, and

1 supplier there is Luzenac who took over
2 ownership from Cyprus Minerals.

3 2000 to 2001, the Argonaut
4 mine, the Rainbow mine, and the Hamm
5 mine. Again the supplier, Luzenac.

6 2001 to 2002 and 2002 to
7 2003, it's the Argonaut mine. Supplier
8 is Luzenac.

9 Q. Now, in terms of the Val
10 Chisone, the Italian mines, do you know
11 what mill was used for the talc that came
12 out of that mine?

13 A. Would you --

14 Q. Where it was processed?

15 A. Oh, where it was processed.
16 It was processed, actually at the Fontane
17 mine, the mill was at the Fontane mine.
18 And that was where it was processed and
19 bagged for shipment.

20 Q. Okay. And do you know
21 specifically for the Val Chisone mines,
22 what shafts were being used during the
23 period of time that Val Chisone was the
24 supplier for the Johnson's Baby Powder?

1 A. I don't know the names of
2 the shafts, no.

3 Q. Where -- do you have any
4 idea where we could get that information?
5 Well, let me ask a question. Maybe it's
6 not as important. Is the geology pretty
7 much all the same between the shafts so
8 that we don't have to really be
9 concerned?

10 A. That is my understanding,
11 yes. I mean, we go back to Professor
12 Pooley who did a thorough interrogative
13 review of that mine. He spent several
14 days down that mine back as far back as
15 in 1971, '72. He wrote up a big story of
16 the geology of that mine or that mining
17 area. And we know that it is a very
18 clean mine, and it doesn't change, at
19 least the area where it's been mined for
20 the last many, many decades. It is
21 pretty well the same.

22 Q. So for example, if they did
23 a test in one shaft and they found X
24 results, you could pretty much say, well,

1 that would be indicative of what would go
2 on in the another -- in the other shafts
3 in the same mine; is that fair?

4 MR. BICKS: Objection to the
5 form.

6 THE WITNESS: Again, I'm not
7 a mining engineer or a geologist.
8 My understanding of the geology is
9 that it is pretty well the same in
10 that area in that Fontane mine.

11 BY MR. PLACITELLA:

12 Q. Now, in terms of the Vermont
13 mines, other than the time that Eastern
14 Magnesia owned the mines, those mines
15 were all ultimately owned by Johnson &
16 Johnson correct?

17 A. They were -- they were owned
18 by a subsidiary company of Johnson &
19 Johnson, called Windsor Minerals.

20 Q. And where was the talc
21 processed for the Vermont mines for
22 Johnson's Baby Powder?

23 A. There was a mill, a talc
24 mill at the Hammondsville -- at the

1 Hammondsville facility, yes.

2 Q. And it was always
3 Hammondsville?

4 A. That is my understanding,
5 yes.

6 Q. Okay. Did the Hammondsville
7 mine, the Hammondsville -- scratch that.

8 Did the Windsor mill process
9 both commercial and cosmetic talc at the
10 same time?

11 A. At the same time? What do
12 you mean by at the same time?

13 Q. During the same time
14 periods?

15 A. The industrial talc has been
16 processed in the Hammondsville mill. Not
17 at the same time. But it has been
18 processed at different times. Yes.

19 Q. Did it use the same
20 equipment?

21 A. I don't have the answer to
22 that. I don't know.

23 Q. Now, in your prior
24 deposition with Mr. Panatier -- do you

1 remember him?

2 A. Yes.

3 Q. You probably can't forget
4 him, right?

5 A. I got on okay with
6 Mr. Panatier.

7 Q. Okay. You had a discussion
8 with Mr. Panatier about the Johnson mine
9 that was owned by Eastern Magnesia.

10 Do you recall that?

11 A. Yes, it was owned by Eastern
12 Magnesia, yes.

13 Q. And you told Mr. Panatier
14 that it was a serpentine mine that was
15 owned by Eastern Magnesia for a few
16 years. Do you recall that?

17 A. I believe that is the case,
18 yes.

19 Q. Okay. And that in the
20 Johnson mine they had a higher level of
21 amphiboles than in the Hammondsville
22 mine; is that fair?

23 A. That is -- that is my
24 recollection, yes.

1 Q. Now, for a short period of
2 time, do you understand that the Johnson
3 mine was actually supplying talc for
4 cosmetic Baby Powder?

5 A. That's not my understanding,
6 no.

7 MR. PLACITELLA: Can you
8 give me Exhibit 4.

9 (Document marked for
10 identification as Exhibit
11 J&J-4.)

12 (Document marked for
13 identification as Exhibit
14 Hopkins-2.)

15 BY MR. PLACITELLA:

16 Q. I'll show you what's been
17 marked as Exhibit 4.

18 MR. PLACITELLA: I know I'm
19 going to be asked what's the first
20 page on the Bates number.

21 I'll tell that you. It's
22 JNJH29W_000003709. So the first
23 one will be 3708.

24 BY MR. PLACITELLA:

1 Q. But I'm focusing on 3709.

2 Do you see where it says, "Eastern
3 Magnesia Talc Company, a Johnson &
4 Johnson company"?

5 Do you see that?

6 A. That's what it says in the
7 top line, yes.

8 Q. Okay. Do you see where it
9 says, "Application: As a base for
10 perfumed baby powder, dusting powder foot
11 powder and pressed cake, packed face
12 powder."

13 Do you see that?

14 A. Yes, you've read what was
15 written. Yes.

16 Q. Okay. And did you
17 understand that the word EMTal stands
18 store Eastern Magnesia Talc Company?

19 A. I do, yes.

20 Q. Do you see on the bottom it
21 says, "EMTal is for cosmetics"? And it
22 says, "The following grades priced f.o.b.
23 the Vermont plants are sold in the
24 cosmetic industry"?

1 Do you see that?

2 A. It does say they are sold in
3 the cosmetic industry, yes.

4 Q. All right. Do you see where
5 it says -- and it has the EMTal, and it
6 has the number.

7 Do you see that?

8 A. Yes.

9 Q. It lists Windsor, West
10 Windsor as the plant?

11 A. Yes.

12 Q. And it also lists Johnson
13 Vermont as a plant.

14 Do you see that?

15 A. It does, yes.

16 Q. And it gives the Johnson --
17 it gives the EMTal number for the Johnson
18 Vermont used for Baby Powder as 500 and
19 549.

20 Do you see that?

21 A. It does, yes.

22 Q. Okay. And if you go to the
23 next page, if you go to Page 3 where it
24 talks about tomorrow's market.

1 Do you see that?

2 A. Yes.

3 Q. On the bottom under 5, it
4 says, "EMTCO," which is Eastern Magnesia
5 Talc Company, "working to replace Johnson
6 EMTals with West Windsor EMTals when and
7 if Johnson cosmetic grades are eliminated
8 due to arsenic content."

9 Do you see that?

10 A. You read what was written.
11 Yes.

12 Q. So is today the first time
13 you learned that the Johnson mine
14 actually supplied cosmetic talc for
15 Johnson & Johnson for a short period of
16 time?

17 MR. BICKS: Objection. No
18 foundation.

19 THE WITNESS: My
20 understanding is that the Johnson
21 mine never supplied cosmetic talc
22 for Johnson's Baby Powder.

23 BY MR. PLACITELLA:

24 Q. That's not what this

1 document says, though, is it?

2 A. I don't see anywhere where
3 it says that Johnson's Baby Powder is
4 supplied from this Johnson mine.

5 Q. All right. Do you see if we
6 go backwards where it says, "Application:
7 B, as a base for Baby Powder"?

8 A. Again, this is a
9 hypothetical document. It's saying we
10 have this cosmetic industry, and we have
11 talc which has an application, a
12 potential application, I would read that,
13 as a base for Baby Powder.

14 There's no -- there's no
15 date on this as to when this was. So...

16 Q. And it says -- it doesn't
17 say hypothetically, right? It says, this
18 is a Johnson & Johnson document. "The
19 following grades priced f.o.b. the
20 Vermont plants are sold in the cosmetic
21 industry," correct?

22 A. It says they're sold in the
23 cosmetic industry. But nowhere does it
24 say that they are sold as Johnson's Baby

1 Powder.

2 Q. Okay. Well, we would know
3 that if we had the fact book going back
4 that far, right?

5 A. What we do know is that
6 the -- part of the talc in Baby Powder in
7 1964 was the phase-in of the Italian talc
8 on the talc from the Hammondsville mine.
9 There's no -- absolutely no evidence that
10 Johnson's Baby Powder ever used talc from
11 a Johnson mine.

12 Q. Well, you are saying no
13 evidence, but here is evidence.

14 A. No, it isn't.

15 This says that someone is
16 proposing that an application could be
17 used as a base for baby powder. There's
18 nowhere that it was ever used in any of
19 the specifications.

20 Q. Just so -- just so -- so I
21 don't want to quarrel with you about
22 this. Just so the record is clear, this
23 talks about an application for baby
24 powder and that the Johnson Vermont talc

1 is being sold to the cosmetic industry in
2 the very same document, correct?

3 A. It says it's being sold
4 as -- someone has written that it's a
5 potential, I read that as potential, they
6 use the word potential in 4 above. Item
7 1-4. So it just says it's possible
8 application in baby powder. Nowhere does
9 it say it's Johnson's powder.

10 Q. Okay. So --

11 A. The company supplied talc,
12 both industrial and cosmetic talc, to
13 other suppliers, in particular industry
14 talc.

15 Q. So Johnson & Johnson owns a
16 mine that's -- and they sell baby powder
17 and they're selling their talc to others
18 who are making baby powder? That's what
19 you're saying?

20 A. No. Nowhere does this say
21 we're actually selling it as baby powder.
22 They're saying that this is -- this is a
23 review document. It talks about the
24 potential market share, how many tons are

1 available, what the EMTal -- EMTCO's
2 shipments or how many plants they've got,
3 and it talks about the business and the
4 business, saying we have the talc, which
5 an application is a base for perfumed
6 baby powder.

7 It doesn't say that they're
8 actually selling it as that. They're
9 saying it's an application.

10 MR. BICKS: For purposes of
11 accuracy, because I think you
12 know, but I think that if you ask,
13 the Johnson mine, I think was only
14 owned by Johnson & Johnson for a
15 very, very brief period of time.
16 So it's important to keep track of
17 the time frame here.

18 MR. PLACITELLA: So how
19 would you like to testify?

20 MR. BICKS: I'm trying to
21 help you out for accuracy because
22 I assume you know this.

23 MR. PLACITELLA: I know a
24 little bit about the Johnson mine.

1 BY MR. PLACITELLA:

2 Q. So you know -- who is Roger
3 Miller?

4 A. He was president of Windsor
5 Minerals, the company that owned the
6 mine, the Hammondsville mine.

7 Q. And you know that he
8 testified under oath while he was working
9 for Johnson & Johnson that the Johnson
10 mine sold cosmetic grade talc, correct?

11 A. I didn't know that. But I
12 believe you if you tell me.

13 Q. Okay. Do I need to show it
14 to you?

15 A. No, I believe you. I said
16 that. I believe if Roger Miller made a
17 statement, then he made a statement.

18 MR. PLACITELLA: Okay. Can
19 you give me 213.

20 (Document marked for
21 identification as Exhibit
22 J&J-213.)

23 BY MR. PLACITELLA:

24 Q. By the way, I want to focus

1 now a little bit on the Hammondsville
2 mine. Okay. There's no question that
3 that was used for cosmetics, correct?

4 A. That's correct. That was
5 used to suppliers cosmetics, yes.

6 Q. And you'll remember the last
7 time we were here together we went
8 through that before it became the
9 Hammondsville mine it was actually known
10 as the Reading Asbestos and Talc Mine?
11 Remember that?

12 A. I wasn't aware of that, no,
13 no.

14 Q. Do you remember -- you
15 testified about that last time?

16 A. I do not recollect
17 testifying that it was an asbestos mine,
18 no.

19 Q. Okay. You don't recall you
20 and I spending some time going over that
21 the last time we were together?

22 A. I do not recollect
23 describing it as a Reading Asbestos mine.

24 MR. BICKS: How are you

1 holding up?

2 THE WITNESS: What time is
3 it?

4 MR. PLACITELLA: Do you want
5 to take a break? Totally up to
6 you. Do you want to take five?
7 Your stamina is great.

8 THE WITNESS: We'll go to
9 half past. We'll go to 11:30.

10 BY MR. PLACITELLA:

11 Q. Exhibit 213 is a January 31,
12 1996 memo entitled "Pilot Flotation Study
13 on Argonaut Ore on West Windsor."

14 Do you see that?

15 A. Yes.

16 Q. Okay. And I'm going to
17 refer you to Bates Number 6749. That
18 states that, "In 1989/90 the plant
19 replaced its existing conventional
20 multi-cell flotation system with three
21 stages of column flotation." It said it
22 never worked. It goes on to say, "Then
23 in 1990/91 the Hammondsville mine ran out
24 of ore and was completely replaced by the

1 Hamm mine."

2 Is that consistent with your
3 understanding?

4 A. Yes.

5 Q. Okay. And of course you
6 know that they were having an arsenic
7 problem during this period of time,
8 correct?

9 A. Who is "they"?

10 Q. People running the Hamm
11 mine.

12 MR. BICKS: Objection to the
13 form.

14 THE WITNESS: It says in the
15 next sentence that there was --
16 arsenic was worse. Yes, they were
17 having to avoid the arsenic areas,
18 certainly.

19 MR. PLACITELLA: Now, can
20 you give me 121.

21 (Document marked for
22 identification as Exhibit
23 J&J-121.)

24 BY MR. PLACITELLA:

1 Q. J&J-121 is a July 16, 1976,
2 memo from Alan Marks to Mr. Marshall.
3 Who is Mr. Marks, if you know?

4 A. I believe he was the
5 marketing manager on the business side.

6 Q. Okay. And does this
7 document indicate that in 1976 the
8 Argonaut mine was approved as an
9 alternate source for Johnson's Baby
10 Powder?

11 MR. BICKS: Objection. No
12 foundation.

13 THE WITNESS: Talc from the
14 Argonaut mine was approved as an
15 alternative source, yes.

16 BY MR. PLACITELLA:

17 Q. In 1976?

18 A. It had been approved, and it
19 was parked, if you like, because there's
20 plenty of mine supply from the
21 Hammondsville mine.

22 Q. And this Argonaut mine was
23 used for cosmetics, will you agree?

24 A. Argonaut talc has been used

1 for cosmetics, yes. In '75 onwards.

2 MR. PLACITELLA: Can you
3 give me 201.

4 (Document marked for
5 identification as Exhibit
6 J&J-201.)

7 BY MR. PLACITELLA:

8 Q. 201 is the specification for
9 Grade 66 for Cyprus Windsor Minerals
10 Corporation.

11 Do you see that?

12 A. Yes.

13 Q. Okay. And if you go to
14 Bates Number 441. I think I tagged it
15 for you to make it easy.

16 A. Yes.

17 Q. That indicates that as of
18 the time this document in 1992 was
19 written, that the following mines are
20 qualified and approved to provide ore for
21 Grade 66 talc. And it lists the
22 Hammondsville mine, the Argonaut mine,
23 the Rainbow mine, and the Hamm mine
24 correct?

1 A. You read what was written.

2 MR. PLACITELLA: Give me

3 211.

4 (Document marked for
5 identification as Exhibit
6 J&J-211.)

7 BY MR. PLACITELLA:

8 Q. J&J-211 is dated January 5,
9 1996. You've seen this before, correct?
10 It's a letter to Carol Wilkes of
11 Johnson & Johnson?

12 A. Yes. I have seen this, yes.

13 Q. And if you go to Bates
14 Number 598, it also discusses the fact
15 that the Argonaut mine was qualified by
16 J&J to supply cosmetic talcum powder in
17 1975, correct?

18 A. That's what is written, yes.

19 Q. And contained in this is a
20 July 17, 1995 letter. Do you see that?
21 It's the -- the Bates number is cut off
22 at the bottom. But it's a letter to a
23 Doug Baker from Johnson & Johnson.

24 Do you see that?

1 A. Yes, I do. Yes.

2 Q. Okay. And as of this point
3 in time, it indicates that Johnson &
4 Johnson has signed off on Argonaut
5 providing 50 percent of the talc used for
6 Johnson immediately, correct?

7 A. Yes. That's what's written.

8 Q. And is it your understanding
9 that by 2000, the Hammondsville mine had
10 totally run out of ore?

11 A. It hadn't actually run out.
12 It was liable to flooding, and so it
13 was -- it wasn't being used.

14 MR. PLACITELLA: That's 222.

15 BY MR. PLACITELLA:

16 Q. Now, for the mines that were
17 owned in Vermont that were owned by
18 Johnson & Johnson, have you ever seen any
19 of the drill core logs. Do you know what
20 a drill core log is?

21 A. Yes, I do.

22 Q. What is that?

23 A. Well, it's a -- well, a
24 drill core is where you take a diamond

1 drill and drill down into the ground to
2 look at the quality of the material that
3 you're going to be mining so you know
4 where to go and where to avoid. And so
5 the geologist can identify where the talc
6 is and where it isn't.

7 Q. Okay. And have you seen
8 drill core logs or have you reviewed
9 drill core logs for all of the mines that
10 were owned by Johnson & Johnson?

11 A. I have seen drill core logs.
12 I'm not sure I've seen all of them.
13 Probably certainly not seen all of them.
14 That's the responsibility of the
15 geologist to define where the talc is and
16 where it isn't. And from that data, you
17 can then move forward to mine good
18 quality talc. But I have seen drill core
19 logs, yes.

20 Q. Do you know whether the
21 drill core logs were all stored in the
22 same place for all the mines that Johnson
23 & Johnson owned?

24 A. I don't know where they were

1 stored. I do not know that, the answer
2 to that.

3 Q. Do you know whether
4 Johnson & Johnson still has the drill
5 core logs for the various mines that it
6 owned historically?

7 A. My understanding is that
8 the -- all that information would have
9 been passed over to Cyprus Minerals who
10 purchased the mining area in that time
11 frame, 1979, '80.

12 Q. So Johnson & Johnson did not
13 retain any of that information? They
14 just handed it all over?

15 A. It became part of the sale
16 of the mine along with the mine logs.

17 MR. BICKS: He said '79,
18 '80. I think he -- '89.

19 THE WITNESS: Sorry, '89.
20 Yeah.

21 BY MR. PLACITELLA:

22 Q. That's fine. What about
23 the -- what's a mineralogic map?

24 A. Mineralogic map is something

1 that you can create once you've got your
2 information from the diamond core drills,
3 you can find out where certain minerals
4 are and where you can avoid certain areas
5 and where, basically if you're looking
6 for talc, you look for where the talc is
7 and where -- where it isn't.

8 Q. Okay. Did Johnson & Johnson
9 maintain mineralogic maps for the mines
10 that it owned historically?

11 A. My understanding, that that
12 was the outcome of the core drilling.
13 You'd then be able to create a
14 mineralogic map, yes.

15 Q. Whose responsibility was it
16 to maintain those maps at Johnson &
17 Johnson?

18 A. The maps were part of the
19 mining operation in Vermont. And they
20 were -- would be the responsibility of
21 the mine operators, which I said was run
22 as a separate operating company. Windsor
23 Minerals Inc. was a separate subsidiary.
24 Although owned by Johnson & Johnson, it

1 was a separate company.

2 Q. Were copies of those maps
3 provided to Johnson & Johnson?

4 A. I personally have not seen
5 copies of those maps. Like I say, the
6 responsibility for mining and going to
7 the mining areas where you're looking for
8 talc is the responsibility of the mining
9 company. And that would -- that should
10 be with the mining company.

11 Q. So Johnson & Johnson has
12 never had possession, physical possession
13 of those maps. Is that what you're
14 saying?

15 A. I don't know the answer to
16 that question, whether they had some of
17 the maps or were able to obtain some.
18 But they're very much part of Windsor
19 Minerals' property, that they would have
20 that, because if you were mining in an
21 area in another state -- I mean, Vermont
22 is quite some distance away from New
23 Jersey -- then that's where you'd expect
24 to have that information.

1 Q. Have you ever seen the
2 mineralogic maps yourself?

3 A. I have not seen -- I have
4 seen a mineralogic map, one or two of
5 these. I reviewed them this past week.
6 I think I've seen certainly one. But for
7 the main mines, no, I have not.

8 Q. When you say main mines,
9 what do you mean by that?

10 A. Well, you mentioned the
11 mine -- the Hamm mine, the Argonaut mine,
12 the Hammondsville mine, the Rainbow mine.
13 Those -- those would be part of the
14 mining operation.

15 Q. Before we break, just going
16 back to the Johnson mine, you know that
17 the Johnson mine was owned by Johnson &
18 Johnson, correct, at one point in time?

19 A. It was probably the Eastern
20 Magnesia Talc Company, and Johnson owned
21 that for a very short period of time. I
22 don't know if it was months. I believe
23 it was months, but not for a long period
24 of time.

1 Q. Why did they get rid of that
2 mine?

3 A. I don't know. I do not want
4 to speculate. It was something going
5 back, I don't know, 50 years now.

6 Q. I'm just asking if you know.

7 A. I do not know, no.

8 MR. PLACITELLA: Okay. This
9 would be a good time if you want.

10 MR. BICKS: Okay.

11 THE VIDEOGRAPHER: All
12 right. Stand by. Remove your
13 microphones. The time is
14 11:23 a.m. Going off the record.

15 (Short break.)

16 THE VIDEOGRAPHER: Okay. We
17 are back on the record. The time
18 is 11:43 a.m.

19 MR. BICKS: Before we start
20 Mr. Placitella, let me just let
21 you know that during this short
22 period of time in response to your
23 comments about this fact book, I
24 believe that certain fact books

1 have been produced to you and we
2 will try to make a good faith
3 effort to try to help you find
4 materials that I think you have
5 access to.

6 But I can tell you that just
7 very quickly doing very basic
8 computer searches, that we
9 identified materials that I think
10 are the ones that you were
11 alluding to.

12 MR. PLACITELLA: I wasn't
13 saying that anyone was holding
14 anything back. I just couldn't
15 find it. So if you give me the
16 fact books, then I'll ask him
17 questions about it.

18 MR. BICKS: Right. I wanted
19 to respond to that, because there
20 is a question whether you had
21 them, whether they were produced.

22 MR. PLACITELLA: Yeah, I
23 couldn't find them. That's all.

24 MR. BICKS: Right, right.

1 MR. PLACITELLA: So whatever
2 you have, you can bring it.

3 MR. BICKS: I wanted to let
4 you know that.

5 MR. PLACITELLA: I
6 appreciate that.

7 Okay. Let me know. We're
8 ready.

9 THE VIDEOGRAPHER: We're on
10 the record.

11 MR. PLACITELLA: We're
12 ready? Oh, we're on the record.
13 Okay.

14 BY MR. PLACITELLA:

15 Q. I wrote down some names of
16 things I found in documents. The first
17 name is benzyl acetate. Do you know what
18 that is?

19 A. It's a chemical, yes.

20 Q. And by trade, you're a
21 toxicologist?

22 A. Yes.

23 Q. Okay. Do you know whether
24 benzyl acetate has ever been incriminated

1 as a carcinogen?

2 A. I know that benzyl acetate
3 is a food flavor material. It's approved
4 for food flavors. I'm not aware that
5 it's ever been listed is as a carcinogen.
6 But it's certainly -- it's used as food
7 flavoring.

8 Q. So you don't know whether it
9 was -- do you know whether it was listed
10 as a known or suspected carcinogen?

11 A. Well, if it's approved as a
12 food ingredient, a food flavor for candy
13 or what have you, then it's highly,
14 highly unlikely that it would be
15 implicated as a carcinogen.

16 Q. Do you know whether that
17 product was ever used in Johnson's Baby
18 Powder?

19 A. Well, again, the answer is
20 that without having a disclosure of the
21 fragrance, I do not know. You've listed
22 an ingredient which is used in flavors.
23 It's used in fragrances. It's used in
24 foods and candies and things like that.

1 So it gets used -- but
2 whether it was ever in Johnson Baby
3 Powder fragrance.

4 Q. What candies, because I'm
5 not going to eat them anymore? Do you
6 know what candy?

7 A. I don't. It is approved as
8 a food ingredient, food flavor.

9 Q. I don't want my kids eating
10 that. The next document, the next name,
11 by the way is what?

12 A. It says benzaldehyde.

13 Q. What's that?

14 A. Again, that's another
15 chemical -- it's one that smells and
16 tastes of almonds. It's the almond smell
17 basically. It's an almond smell. Again,
18 that's -- that is used in food flavoring
19 as well.

20 Q. And do you know if that's
21 ever been incriminated as a known or
22 suspected carcinogen?

23 A. Again, if it's approved in
24 food flavorings, then the intention must

1 be that it was never regarded as a
2 carcinogen. It is a food flavoring
3 ingredient. So it should not be. You
4 would not -- the agencies that approve
5 food flavorings are not going to approve
6 carcinogens.

7 Q. That's okay. You can eat
8 that stuff.

9 A. The science of toxicology
10 relates to how much dose. There are
11 many, many ingredients that are hazardous
12 at high levels, and at safe levels, the
13 body metabolizes them, excretes them, and
14 they're safe. So it all depends on dose.

15 Q. Just yes or no. Has this
16 chemical ever been incriminated as a
17 known or suspected carcinogen, if you
18 know?

19 MR. LOCKE: Objection.

20 THE WITNESS: Again, I don't
21 have that information in front of
22 me. I'm not aware that it has.

23 But I don't have that information
24 to give you 100 percent definitive

1 answer.

2 BY MR. PLACITELLA:

3 Q. All right. So if for
4 example your supplier was giving you that
5 and they were keeping it secret from you,
6 you wouldn't know that?

7 MR. BICKS: Objection to the
8 form.

9 THE WITNESS: Again, you're
10 asking me to speculate. What I've
11 said is that when a supplier
12 provides a fragrance, the supplier
13 does so from a list of fragrance
14 ingredients that are recognized as
15 safe. They use that as a basis to
16 move ahead and formulate their
17 fragrance --

18 BY MR. PLACITELLA:

19 Q. Well, whose --

20 A. -- using it as a fragrance.

21 Q. Just so we're clear,
22 recognized as safe from their own trade
23 association?

24 A. No. There is a --

1 Q. Correct?

2 A. No. There's a designation,
3 GRAS, generally recognized as safe. And
4 that designation is given by the EEA. It
5 comes under auspices of the Food and Drug
6 Administration for many ingredients, many
7 flavors. Specifically, its GRAS
8 status -- GRAS status. So --

9 Q. So it's your testimony that
10 these two chemicals that we've gone
11 through so far have been recognized by
12 the FDA as safe?

13 A. No, that's not my testimony
14 at all. Without doing extensive research
15 into looking at the safety profile of
16 those ingredients and where they're used
17 and how they are used, I couldn't answer
18 that question.

19 Q. Okay.

20 A. Again, it's speculative.
21 And without having done the extensive
22 research to look at -- I mean, there are
23 three thousand different fragrance
24 ingredients. I could not remember every

1 single toxicology profile that's ever --

2 Q. I'm not asking you to, sir.
3 I want to know what you know, or what J&J
4 knows.

5 The next chemical, what's
6 that?

7 A. Citral.

8 Q. What is that?

9 A. Citral is a simple chemical.
10 It's main constituent of oranges and
11 lemons. It's certainly an orange peel
12 lemon peel. Again, that's widely used in
13 candy flavors, food flavors. It's a
14 simple naturally occurring molecule.

15 Q. Do you know whether that's
16 ever been incriminated as a known or
17 suspected carcinogen at any level?

18 A. I do not know if it has been
19 implicated as a known carcinogen. It
20 is -- again, it is -- we eat it every
21 day. If you eat jam or marmalade made
22 from oranges, then you're eating quite a
23 lot of citral.

24 Q. Okay. I'm learning

1 something. I'm going to change my diet
2 after this dep. Coumarin, what is that?

3 A. Coumarin is -- again,
4 it's -- it is a flavor. It has a
5 particular note that's used in some
6 flavors and fragrance.

7 Q. Has it ever been implicated
8 as a known or suspected carcinogen?

9 A. I don't believe coumarin
10 has. There are derivatives of coumarin.
11 I think one is 7-hydroxy-coumarin, which
12 is a suspect material. But coumarin is
13 used in fragrance, and it's used in
14 flavors.

15 Q. Okay. The next one, give me
16 the right pronunciation.

17 A. Limonene. Or D-limonene.
18 Again, limonene is -- it's exactly the
19 same as citral. If you eat orange jam or
20 orange marmalade or those products, it is
21 a main constituents of citrus peel.

22 Q. Do you know if that's ever
23 been incriminated as a known or suspected
24 carcinogen?

1 A. I do not believe it has.

2 We're eating -- well, if you
3 eat oranges or orange marmalade or orange
4 jam. There are many, many chemicals.

5 Q. I want to make sure, if I
6 don't eat the peel I'm not eating this
7 stuff, right? I want to get something
8 out of this deposition.

9 A. There will be -- there will
10 be some limonene in the fruit, in the
11 actual orange itself. Yes.

12 Q. Okay. And the last one?

13 A. Eugenol. Yeah, eugenol
14 is -- again, that's used in flavors and
15 fragrances. It's also used in dentistry
16 as a packing material in a cavity if you
17 have a cavity, dentist will put some
18 eugenol in as a base for the filler
19 material, restorative material. It's
20 been used -- eugenol a natural material.
21 It's found in many, many flower extracts.

22 Q. Has that ever been
23 implicated as a known or suspected
24 carcinogen?

1 A. Not to my knowledge, no.

2 Q. Do you know as you sit here
3 today whether any of these chemicals that
4 I've highlighted were ever put in
5 Johnson's Baby Powder?

6 A. I don't have the answer to
7 that. They may or may not have been part
8 of the fragrance or fragrances. Like I
9 said, if you have a lemon peel extract or
10 an orange peel extract, they could well
11 contain some citral or limonene.

12 Q. But you don't know as you
13 sit here today?

14 A. I don't, because as we said
15 earlier, the formulation for the
16 fragrance is proprietary to the fragrance
17 company.

18 Q. Right. It was kept secret
19 by them from you?

20 A. And that's standard
21 throughout the whole -- whether you're
22 fragrance is a body wash or shampoo or
23 what have you.

24 Q. Okay. So you have

1 previously testified, am I correct, that
2 Johnson & Johnson had a no tolerance
3 policy for carcinogens in the Johnson's
4 Baby Powder, correct?

5 A. Yes.

6 Q. Okay. And you testified in
7 the Herford trial that if you found out
8 that the product contained a carcinogen,
9 you would pull it from the market,
10 correct?

11 A. Yes. If a product was
12 carcinogenic, you wouldn't sell it. It
13 would actually be illegal, I think.

14 Q. No, if the Johnson's Baby
15 Powder or Shower to Shower contained a
16 carcinogen and you found out about it,
17 you would pull it from the market,
18 correct?

19 A. If the product was
20 carcinogenic, you would pull it from the
21 market.

22 Q. Okay. Now, is there a safe
23 level, to your knowledge, for exposure or
24 ingestion of nickel?

1 Well, let me ask the
2 question --

3 A. Okay. As a toxicologist --
4 can I answer as a toxicologist?

5 Q. Well, let me ask you the
6 question this way.

7 Is -- has nickel been
8 implicated as a known or suspected
9 carcinogen?

10 A. There are -- I think there
11 are about 200 different kind of nickel
12 salts. Certain nickel salts, some of
13 those are implicated as carcinogens. On
14 the other hand, nickel is recognized by
15 nutritionist as what's known as a
16 micronutrient. In other words, we need a
17 small amount of nickel to metabolize
18 carbohydrates. It's probably nanograms
19 per day. But along with several other
20 micronutrients like cobalt, and others,
21 it is regarded as part of our diet. And
22 certainly nickel is found in many, many
23 foods.

24 Q. Has nickel been implicated

1 as a carcinogen, yes or no?

2 A. Okay. Nickel fumes, where
3 nickel or nickel ores are roasted in
4 smelting operations where mine work --
5 sorry, workers are manufacturing
6 stainless steel from nickel alloys, there
7 is indications -- there is an I-A-R-C,
8 IARC, review which indicates that, in
9 those circumstances, nickel can be a
10 carcinogen.

11 But it's also -- as I said,
12 it's also part of our diet. And like
13 iron and magnesium, we take it in every
14 day.

15 Q. But the answer to my
16 question is, nickel is considered a
17 carcinogen?

18 A. Nickel is considered by the
19 International Agency For Research on
20 Cancer as a carcinogen to employees,
21 workers, exposed to high levels of nickel
22 fumes in those circumstances. So the
23 answer to that part of the question is
24 yes.

1 Q. Okay. Is chromium
2 considered a carcinogen?

3 MR. SILVER: Objection to
4 form.

5 THE WITNESS: Similar story.
6 I mean, I take a chromium
7 supplement every week. It's
8 chromium picolinate. Chromium is
9 again one of those micronutrients
10 that we need in our diet to help
11 metabolize glucose.

12 There are dozens and dozens
13 of different chromium salts. The
14 international agency for research
15 on cancer has identified what are
16 called hexavalent chromium as a
17 carcinogen. But that's quite
18 different from the chromium that
19 we have in our diet.

20 BY MR. PLACITELLA:

21 Q. So the answer to my question
22 is chromium is considered a carcinogen?

23 MR. SILVER: Objection to
24 form.

1 THE WITNESS: Certain
2 chromium salts in what are called
3 a hexavalent form are considered
4 by the International Agency For
5 Research on Cancer as potentially
6 carcinogenic at those appropriate
7 dose levels. There are many
8 chromium salts which are reviewed
9 and not considered as
10 carcinogenic.

11 BY MR. PLACITELLA:

12 Q. What about cobalt? Is that
13 considered a carcinogen?

14 MR. SILVER: Objection to
15 form.

16 THE WITNESS: No, without
17 cobalt we'd die. Cobalt is the
18 center of the -- there's a vitamin
19 B12 that we take in our diet or we
20 take as a supplement, and every
21 molecule of vitamin B12 has cobalt
22 at its center.

23 So cobalt in its nutritional
24 state is not a carcinogen.

1 BY MR. PLACITELLA:

2 Q. Okay. What about in its
3 non-nutritional state? Is it a
4 carcinogen?

5 A. Well, there are -- again, as
6 with nickel and many others, there are
7 many, many different salts. I think the
8 overview is that cobalt, you're unlikely
9 to be exposed to much cobalt. It's just
10 not -- it's only present in parts per
11 million in the soil; and therefore, it's
12 in most of our diet, in grains, juices,
13 fruits, various things we eat. So at
14 certain dose levels that we take in our
15 diet, it's an essential requirement.

16 Whether taking vast amounts
17 would be carcinogenic, I don't know. I'm
18 not aware that anyone has ever exposed
19 themselves to extremely large amounts.

20 Q. So let me ask you this.
21 With respect to Johnson Baby Powder or
22 Shower to Shower, was there a limit of
23 the amount of nickel that would be
24 permitted to be included in the product?

1 A. Yes. The specification for
2 the talc has a specification where it
3 sets a limit for nickel.

4 Q. What is that?

5 A. Let me think. Let me think.
6 Is it .5 parts per million. I haven't
7 got the document in front of me. I don't
8 want to get into a memory test. There is
9 a specification. That has been provided.
10 And it lists out the limits for things
11 like heavy metals at 10 parts per
12 million, arsenic at between 2 and 3 parts
13 per million.

14 Q. Okay. Let's go through
15 that.

16 So -- and if it turns out
17 that you're wrong, you're wrong. We'll
18 fix it. Arsenic, you think the limit is
19 what? Let's write them down so we have
20 it.

21 A. Arsenic reflects the
22 specification of the United States
23 Pharmacopeia for talc. The limit
24 currently, I believe, is 2 parts per

1 million. It has varied between 2 and 3,
2 but it's always been within the limits of
3 the United States Pharmacopeia.

4 Q. Okay. So one, nickel,
5 .5 parts per million?

6 A. Again, I would need -- this
7 is not a memory test. I would need to
8 look. And you have the specification of
9 products. We can look it up at any
10 point.

11 Q. Well, if you have something
12 that you want to look at, please let me
13 know.

14 A. No, I've only got what
15 you've given me. I don't have it here.

16 Q. Okay. Well, if you want to
17 take a break and look, that's fine.

18 Arsenic?

19 A. Again, it meets the United
20 States Pharmacopeia, which currently --
21 which currently the J&J talc one is 2
22 parts per million.

23 Q. Okay.

24 A. At times varied between 2

1 and 3.

2 Q. 2 parts per million.

3 Okay. What about cobalt?

4 A. Again, I can't remember it.

5 It's the -- if it's -- whatever isn't the
6 United States the Pharmacopeia limit, the
7 company has chosen to adopt either the
8 European Pharmacopeia or the
9 International Pharmacopeia.

10 And again, I cannot remember
11 what it is, but there is a specification
12 for cobalt which meets the -- any of
13 the -- the best of the international
14 standards.

15 Q. You don't know what it is?

16 A. Without looking it up, no, I
17 don't. You have that data in the -- in
18 the files as a specification.

19 Q. Okay. Well, you have the
20 data too, don't you? I got it from you.

21 A. Yeah, I didn't bring it with
22 me.

23 Q. Okay. But you did look --
24 you did look at it, right?

1 A. You've got it -- you've got
2 it right there.

3 Q. Okay. All right. What
4 about lead?

5 A. Yes. There's a limit for
6 lead.

7 Q. How much?

8 A. I believe it's currently 10
9 parts per million. Again, not just in
10 the United States Pharmacopeia.

11 Q. Okay. And what about
12 chromium?

13 A. Did we do chromium? I can't
14 remember. Again, it matches whatever the
15 best of the International or United
16 States Pharmacopeias.

17 Q. What's the best?

18 A. Again, I can't remember
19 without checking the -- checking the
20 specification.

21 Q. Okay.

22 A. But you have that
23 information.

24 MR. PLACITELLA: Okay. Can

1 you give me Exhibit 93.

2 BY MR. PLACITELLA:

3 Q. I know I've gone through
4 this with you before. But Mr. William
5 Ashton, we know who he is?

6 A. Yes.

7 Q. Who -- what was his role at
8 Johnson & Johnson?

9 A. He was a senior research
10 scientist involved with talc.

11 Q. Okay. Was he politely known
12 as Mr. Talc?

13 A. Yes. I've seen that
14 descriptor. And he was an expert in
15 talc.

16 Q. And who is Mr. G. Lee?

17 A. George Lee, he was a senior
18 scientist in the baby products division.

19 Q. And what about D.R.
20 Petterson, who was he?

21 A. Petterson with two Ts?

22 Q. Mm-hmm.

23 A. He was -- he was -- I think
24 he was a research director at some point.

1 P-E-T-T. Yes.

2 Q. And how about Dr. Semple?
3 Who was he?

4 A. He was a medical director.
5 He's M.D. qualified. At one point he
6 also became research director in the
7 1980s.

8 Q. So he was the medical
9 director for the whole company?

10 A. For the baby products
11 company.

12 Q. I'm going to show you
13 Exhibit 93.

14 MR. PLACITELLA: I have a
15 bunch of copies. If they're
16 short, we made a lot.

17 MR. BICKS: Some of them you
18 highlighted.

19 MR. PLACITELLA: Yeah, I
20 highlighted on purpose.

21 MR. BICKS: What?

22 MR. PLACITELLA: I -- that's
23 my highlighting.

24 (Document marked for

1 identification as Exhibit

2 J&J-93.)

3 BY MR. PLACITELLA:

4 Q. So you have in front of you
5 Exhibit 93 which is an April 28, 1976
6 confidential memo from Mr. Ashton
7 entitled "Trace Metals in Talc."

8 Do you see that?

9 A. I see that, yes.

10 Q. And Mr. Ashton starts out
11 saying, "There's a wide variety of trace
12 metals in talc at the levels of parts per
13 million and below. Our Vermont talc
14 contains more different metals than do
15 other high grade talcs in the number of
16 metals and the content of those metals."

17 Do you see that?

18 A. Yes.

19 Q. And you've seen this
20 document before?

21 A. I believe I have. Yes.

22 Q. Okay. He then goes on to
23 say, in terms of limits, "Our talc is
24 produced under a spec of a maximum of 2

1 parts per million for arsenic and 10
2 parts per million for heavy metals,
3 reported like lead," correct?

4 A. Yes. That is what is
5 written, yes.

6 Q. Okay. And he talks about an
7 analysis that was done of your product,
8 correct?

9 A. Yes.

10 Q. Okay. And in that analysis
11 he says -- he talks about iron, nickel,
12 copper, magnesium, aluminum, silicon,
13 calcium, titanium, chromium, manganese,
14 and zinc, correct?

15 A. Yes.

16 Q. Okay. And he states on the
17 first page that using the x-ray
18 florescence methodology, he normally sees
19 metals above 15 or 20 parts per million
20 inside and outside of the talc lattice,
21 correct?

22 A. Yes. You read what he
23 wrote.

24 Q. That's higher than all the

1 numbers that you just gave me, right?

2 A. Well, that's inside and
3 outside, the talc lattice. The numbers
4 that I gave you related to those metals
5 which would be available. If it's
6 trapped inside the talc lattice, it is
7 trapped. It will never come out.

8 Q. Well, it says inside and
9 outside, doesn't it?

10 A. Yes. And he's combined the
11 two.

12 Q. So clearly he believes some
13 of it's getting out or he wouldn't have
14 wrote it that way?

15 MR. BICKS: Objection to
16 form.

17 THE WITNESS: No, it
18 can't -- it won't get out if it's
19 trapped in the lattice.

20 BY MR. PLACITELLA:

21 Q. So there's some outside, and
22 there's some inside?

23 A. That would be the inference.

24 Q. Okay. On the next page when

1 it comes to nickel, he says, "It's normal
2 to find about 1,500 parts per million in
3 Vermont 66, and over the past few years
4 it has ranged from 1,000 parts per
5 million to 3,000 parts per million,"
6 correct?

7 A. Yes. That's -- that, as we
8 said two minutes ago, is the material
9 that is -- and he talks about it on the
10 next page, Page 3, which is evidence that
11 it's tied up in the lattice. It will not
12 come out. It is part of the structure of
13 the inside of the talc particle. It's
14 not soluble. It's part of the crystal
15 structure.

16 Q. Okay. What was my question?

17 A. You said what was there. I
18 said yes, I agreed with what you had
19 written, up to 3,000 parts per million.

20 Q. Up to 3,000 parts per
21 million.

22 A. Yes, and I --

23 Q. And that compares -- and you
24 told me that the permissible level for

1 nickel was .5 parts per million. So how
2 many more times -- it looks to me that
3 would be like 6,000 times more reported
4 than you say was allowable?

5 A. No. You're comparing apples
6 with pears. The test method to measure
7 the allowable limit is the amount that
8 will actually come out when you do the
9 test. In other words, what could be
10 available to be on the -- be onto the
11 skin. If something is trapped inside,
12 then it's trapped inside. It will never
13 come out. So it's important when we look
14 at the test method, when we set a limit,
15 that test method measures what is
16 actually available and what can come out
17 into -- out from the product.

18 Q. Why are you testing all this
19 stuff if you don't care about it?

20 A. That's not true. We do care
21 about it. What you're testing is to
22 assure that the amount that may be
23 available to come out and contact the
24 skin is within the limits that you've

1 set.

2 Q. Well, you understand that
3 biologically, even if it's within the
4 talc lattice, once it gets into the body,
5 it will be processed and some of that
6 will become available to human tissue,
7 correct?

8 A. No, it's not correct.
9 There's no enzyme in the human body which
10 will dissolve a talc molecule or
11 particle.

12 Q. Okay. So it's your
13 testimony that the 3,000 parts per
14 million was within the permissible range
15 of nickel in your talc?

16 A. Permissible range relates to
17 the material that's available. And
18 that -- the talc specification specifies
19 a limit. And we are talking clearly
20 apples and pears. If you are talking
21 about the 2- to 3,000 parts per million,
22 that is not available, and that's not
23 measured. It's only measured when you
24 use a particular form of analysis, atomic

1 absorption spectroscopy, which looks
2 right inside the talc molecule, talc
3 particle.

4 Q. So no one was worried about
5 this back then? They were just writing
6 it down?

7 MR. BICKS: Objection to the
8 form.

9 THE WITNESS: People were
10 interested to know the full
11 structure of the -- atomic
12 structure of the talc particle.
13 And, therefore, by using atomic
14 absorption, you're able to say,
15 hey, there's actually 2- to
16 3,000 parts per million of nickel
17 trapped inside.

18 But because we've done the
19 appropriate tests according to
20 United States Pharmacopeia and
21 other Pharmacopeias, we know that
22 that is not biologically
23 available.

24 BY MR. PLACITELLA:

1 Q. Can you show me what tests
2 you conducted specifically
3 contemporaneous with this report that
4 would indicate that none of the nickel
5 reported in this 3,000 parts per million
6 came outside the talc lattice?

7 A. Okay. I have reviewed that
8 document the last couple of days. There
9 is a study which used iron probe analysis
10 to look at that. And further studies
11 using simulated gastric juice to see if
12 you could dissolve it out. Those
13 studies, I'm 110 percent sure were given
14 to yourselves. That's part of the
15 document depo.

16 Q. Well, can you produce that
17 document for me? Do you have it
18 somewhere? You said you relied upon it.
19 It's part of your testimony?

20 A. I've seen it this week, yes.
21 I don't have it in front of me, but it is
22 available.

23 Q. You can get it at a break
24 and give it to me?

1 A. It's already been made
2 available to you as well.

3 Q. Okay. But you'll give it to
4 me so I can ask you questions?

5 MR. BICKS: Direct those
6 questions to me rather than to
7 him, the materials that you have
8 that you can't find.

9 BY MR. PLACITELLA:

10 Q. Okay. The next listing says
11 that you found cobalt up to 90 parts per
12 million, correct?

13 A. By -- by that test method of
14 atomic absorption, yes, that's right,
15 yes.

16 Q. And that you found chromium
17 in your product from 100 to 300 parts per
18 million, correct?

19 A. By that particular test
20 method, yes.

21 Q. Okay. Now, can you go to
22 the next page where it talks about
23 nickel. It talks about heavy metals in
24 the Vermont talc, Vermont 66.

1 Do you see that?

2 A. Yes.

3 Q. And it says, "We have firm
4 documentation that the nickel in our talc
5 is tied up in the talc lattice."

6 Do you see that? That's
7 what you just said, right?

8 A. Yes.

9 Q. Okay. Then it says, "The
10 documentation supports recent statements
11 to the media. The documentation does not
12 mean that all the nickel in our talc
13 concentrate is tied up in the lattice.
14 It is very likely that it's not all tied
15 up in the talc."

16 Correct?

17 A. Yes. You read what is
18 written. And that is correct.

19 Q. Now, go to the -- Page 4,
20 under general comments, Mr. Ashton
21 states, "Although the recent adverse talc
22 publicity only alluded to the presence of
23 nickel and cobalt in a few places, we
24 must prepare for the inevitable

1 probability that investigators other than
2 Mount Sinai will be taking deeper looks
3 into trace metals in talcs."

4 Do you see that?

5 A. Yes, that's what he wrote.

6 Q. And he states, "The data
7 attached gives a picture of our
8 vulnerability compared to some body
9 dusting powder talcs in the U.S.A.

10 Also included is data I have
11 just developed on key trace metals in our
12 head feed, the tailings, and their
13 concentrate, V 66?"

14 Then he concludes, "I'm not
15 too happy with the implications,
16 particularly since I have high degree of
17 confidence in the reliability of the
18 data," correct?

19 A. You read what he wrote in
20 1976, yes.

21 MR. PLACITELLA: Give me
22 142.

23 (Document marked for
24 identification as Exhibit

1 J&J-142.)

2 BY MR. PLACITELLA:

3 Q. 142 is a January 28, 1977,
4 another letter from Mr. Ashton.

5 Do you see that?

6 A. Yes.

7 Q. To a Mr. Arnold Netherwood.
8 What was his job?

9 A. He was a scientist in the UK
10 company.

11 Q. Okay. And in this document,
12 Mr. Ashton documents that chromium can
13 exist in your talc in the United States
14 between 100 parts per million and up to a
15 thousand parts per million?

16 A. That's what he wrote at that
17 time, yes.

18 Q. On the next page he talks
19 about the methods that are available for
20 testing, correct? It says depending on
21 what test you use, that will dictate how
22 much chromium you'll find, right?

23 A. What he actually said --
24 let's be clear -- a good analyst will get

1 almost zero for chromium content in talc
2 using acid leach recipe but might find up
3 to 1,000 parts per million with atomic
4 absorption.

5 Q. Right, so --

6 A. As I said earlier, atomic
7 absorption is the system whereby you can
8 look at what's trapped inside the crystal
9 lattice. It is not the same as what
10 might be biologically available by being
11 leached out or washed out or get onto
12 body tissues.

13 Q. Well, atomic absorption is
14 used for testing what's both inside and
15 outside, correct?

16 A. Yes.

17 MR. PLACITELLA: Okay. Give
18 me 144. Oh, I'm sorry.

19 Give me 157.

20 (Document marked for
21 identification as Exhibit
22 J&J-157.)

23 BY MR. PLACITELLA:

24 Q. 157 is a memo from

1 Mr. Sherman to George Lee. Who is
2 Mr. Sherman?

3 A. I think he was in the
4 formulation department of the baby
5 products company. 1977, yes.

6 Q. And -- and in this document,
7 what Mr. Sherman does is he tries to
8 calculate just how much nickel someone
9 would inhale use -- who came in
10 connection with the Baby Powder, correct?

11 A. He's made a -- he's made a
12 calculation which is in this letter, yes.
13 He's made a calculation.

14 Q. And in this calculation he
15 states that by his information,
16 .48 percent of the total nickel in the
17 talc can be leached out, correct?

18 A. By conditions of a
19 particular test with human serum and
20 gastric juice.

21 Q. Human serum meaning what's
22 in the body?

23 A. Well, it's in the blood,
24 circulating in the blood, yes.

1 Q. All right. So by what's
2 circulating in the blood and by the
3 gastric juices in the human body, he
4 states that almost half of the nickel
5 will be leached out, correct?

6 A. No. No. He's saying
7 0.4 percent of the nickel can be leached
8 out using serum and gastric juice,
9 .50 percent, 0.48 percent.

10 Q. So what happens is when
11 somebody inhales the Johnson's Baby
12 Powder, he's calculating just how much
13 nickel will be absorbed into the human
14 body, correct?

15 A. No. Again, I'll say that
16 this gentleman was not -- is not a
17 toxicologist. And he's done a
18 back-of-the-envelope calculation. But
19 when we inhale particles like talc,
20 pretty well all of it, we breathe in --

21 Q. Sir, I'm not asking for your
22 opinion. I'm asking for what's been
23 stated here.

24 A. Well --

1 Q. What he states in this memo
2 is his calculation about what happens in
3 the human body when the talc is breathed
4 in, correct?

5 A. He's used human serum, which
6 is the blood. He's used gastric juice,
7 which is the stomach, and said that no
8 more than .48 of 1 percent could be
9 leached, no more than that could be
10 leached under those conditions in a
11 laboratory test.

12 Q. And he copied this memo to
13 the entire head on the medical side of
14 your company, correct?

15 A. He's copied it to the
16 medical director, Bruce Semple, yes.

17 Q. Okay. Now, you're aware
18 that -- would you say that arsenic -- is
19 it your testimony by the way that arsenic
20 is trapped within the talc lattice?

21 A. No. That's not my
22 testimony. No. Arsenic can be free, and
23 certainly when the miners are mining the
24 talc, they can see the arsenic, because

1 it's bright yellow in the mine. So they
2 avoid that. But it is free arsenic
3 salts, yeah.

4 Q. Okay. And that historically
5 was a problem for Johnson & Johnson in
6 terms of the Vermont 66 product, correct,
7 arsenic?

8 A. The area -- one of the
9 mines -- I believe it was Rainbow mine --
10 I'm sorry, the Argonaut mine, had areas
11 of arsenic. And the whole point of the
12 mine mapping was to know where those
13 areas were and to avoid that problem. If
14 the miners came across that
15 yellow-stained areas, they would avoid
16 that. I believe the direction was to
17 keep one shovelful away -- a shovel is
18 eight feet wide -- to avoid those areas.

19 So a theoretical problem.
20 But by adopting sensible mining
21 procedures, you -- you avoided a problem.

22 Q. So you could just see it,
23 and it would never become -- it would
24 never be in your product; is that right?

1 Is that what you're saying?

2 A. You can see arsenic
3 compounds stained yellow against the
4 white of the talc. If there's veins of
5 arsenic compounds, you can avoid those.
6 And so you're able to ensure that the
7 product met the specification as given in
8 the United States Pharmacopeia of either
9 2 or 3 parts per million.

10 Q. So arsenic never ended up in
11 the Vermont 66 processed product above 2
12 parts per million. Is that your
13 testimony?

14 A. The specification varied
15 between 2 and 3 parts per million.

16 Q. Let's say 3.

17 A. Okay, 3. So that was the
18 specification. And that is the
19 requirement for the talc.

20 Q. That wasn't my question. My
21 question was, so the arsenic never
22 exceeded 3 parts per million in the
23 Vermont 66 processed talc? Is that your
24 testimony?

1 A. I'm aware, having read
2 through the documentation, that there was
3 one batch where there was what's called a
4 deviation from the specification, where I
5 believe it was 3.1 or 3.2 percent. And
6 that had to go to the medical division to
7 be approved. But that was one -- just
8 one batch over many, many decades.

9 The limit has varied between
10 2 and 3 parts per million of arsenic.

11 Q. So your testimony here under
12 oath is if we go back and we look at all
13 the tests, there was only one time where
14 the arsenic limit was exceeded in Vermont
15 66 talc, right? That's your testimony?

16 A. I'm only aware of -- I'm
17 only aware of one. And whenever any
18 material is what's called out of
19 specification, it is prevented from going
20 further until there's an approval through
21 what's called a deviation system. And a
22 whole bunch of people, the medical
23 department, scientist department, have to
24 sign off to approve that deviation.

1 I'm certainly aware of one.
2 Maybe there were others. I don't know.
3 But as a general rule, the specification
4 for arsenic was either 2 or 3 parts per
5 million which matched that of the United
6 States Pharmacopeia.

7 Q. Okay. And if it ever
8 exceeded 2 or 3 parts per million, that
9 product should absolutely not be sold,
10 correct?

11 A. No. What I said was -- and
12 this is a common thread to any product
13 whether it's shampoo and the pH is
14 slightly different. It's held and
15 bonded, and it cannot be moved forward
16 unless a whole bunch of people sign off
17 and say that it's safe and acceptable.

18 Q. So you can sell it above 3
19 parts per million?

20 A. If the senior medical
21 division people, the toxicologists say
22 3.1, we believe that's acceptable, that's
23 up to them. So I believe there's
24 certainly maybe one case over many

1 decades where that was the case. But
2 it's -- it isn't just automatic. It has
3 to be approved.

4 Q. Okay. So this is important.
5 So only one time you're aware of that the
6 product was sold with arsenic above 3
7 parts per million?

8 A. I'm only aware of one time.

9 Q. Okay. Now, you know they
10 had arsenic problems in the Argonaut mine
11 too, right?

12 A. Yes, I did actually mention
13 Argonaut three minutes ago. That was the
14 one where when you do the mine mapping,
15 you can look at the arsenic salts, which
16 give out yellow stain, and the people
17 doing the mining are shown how to avoid
18 that area by a shovelful width away from
19 it.

20 Q. Okay. And you're aware that
21 there was also arsenic in the Rainbow
22 mine, correct?

23 A. Yes. You can get -- again,
24 the mine mapping will show may be areas

1 that you have to avoid. We look at many
2 square miles here in some cases. So you
3 can look to avoid areas where you want to
4 avoid arsenic.

5 Q. Well, you had arsenic in the
6 Rainbow mine up to a thousand parts per
7 million, correct?

8 A. In the mine or in the talc?

9 Q. In the mine.

10 A. Yes. That's what I said.
11 There are going to be areas where it's
12 clear that there are arsenic areas that
13 have to be avoided. The whole point of
14 mine mapping and doing the core drilling
15 to create a mine map is to identify the
16 areas that are to be avoided.

17 And in this particular case,
18 the areas were identified as
19 arsenic-bearing rock and you avoid
20 arsenic bearing rock. So you don't get
21 the product contaminated by arsenic.

22 Q. Yeah, but the problem was,
23 even as of 1992, you still weren't
24 regularly monitoring the arsenic content

1 in your mines, right?

2 A. You monitor the arsenic
3 content in the finished product.

4 The arsenic is very -- the
5 arsenic salts are very, very visible.
6 They are bright yellow in color. And the
7 mining people are trained to avoid those
8 areas in the same way that they'd avoid
9 other areas that aren't clearly not talc.

10 MR. PLACITELLA: Can you
11 read my question back, please.

12 (Whereupon, the court
13 reporter read back the requested
14 portion of testimony.)

15 THE WITNESS: You monitor
16 the arsenic content by the
17 material you're pulling out of the
18 mine. You can carry on doing core
19 drilling, holes, and looking at
20 where it was in the mine. But the
21 other way of monitoring the
22 content of the mine, to answer
23 that question specifically, is to
24 monitor what you're taking out of

1 the mine.

2 MR. PLACITELLA: Can you
3 give me 200, please.

4 (Document marked for
5 identification as Exhibit
6 J&J-200.)

7 MR. PLACITELLA: The Bates
8 number is 219720.

9 MR. LOCKE: When you get an
10 exhibit number like 200, is that
11 an exhibit number for this
12 deposition?

13 MR. PLACITELLA: Correct.

14 MR. LOCKE: It's marked that
15 way?

16 MR. PLACITELLA: Correct.
17 It's otherwise Imerys 219720.

18 BY MR. PLACITELLA:

19 Q. Have you seen this document
20 before, Dr. Hopkins?

21 A. No, I'm sorry. I'm reading
22 it to actually familiarize to it. I've
23 not seen this before. This appears to be
24 an Imerys document, so I've not seen this

1 one before, no.

2 Q. Okay. And here it says,
3 "Arsenic iron sulfides."

4 And what's that next word?

5 A. Where are you reading?

6 Q. Under arsenic.

7 A. "Arsenic iron sulfides,
8 arsenopyrite." Pyrite is an iron salt.

9 Q. All right. And then do you
10 see where it says, second line, "Total
11 arsenic as analyzed in the Ludlow Rainbow
12 deposit averages generally less than
13 100 parts per million, but with some
14 small zones in excess of 1,000 parts per
15 million. No apparent major effort is
16 underway to regularly monitor or
17 completely assess the total arsenic
18 content of ores, tailing solids, and
19 waste, although the distribution of
20 sulfides and arsenates in a talc ore
21 system is generally understood."

22 Do you see that?

23 A. Yes.

24 Q. Okay. Now, in reviewing --

1 I want to spend a little time now
2 focusing on the issue of -- and we'll
3 come back to some of this later, but on
4 the issue of asbestos in the products
5 that were sold by Johnson & Johnson.
6 Okay?

7 A. I'm listening.

8 Q. Okay. So let's -- I want to
9 see if we can start out definitionally on
10 the same page. Okay.

11 MR. PLACITELLA: Can you
12 give me 193 and 201?

13 BY MR. PLACITELLA:

14 Q. Do you have 201 over there?
15 Do you have 201 with you?

16 A. What's it look like?

17 211. Let's go back to some
18 of these others.

19 MR. BICKS: What's the other
20 one?

21 MR. PLACITELLA: They are
22 the same. It's fine.

23 BY MR. PLACITELLA:

24 Q. If you look at the Bates

1 number that ends in 440 in this group,
2 it's the material specification for
3 Windsor 66 talc.

4 A. Yes.

5 Q. And in defining asbestos it
6 says asbestos is defined to be the
7 fibrous serpentine chrysotile and the
8 fibrous forms of the amphibole group as
9 represented by amosite, anthophyllite,
10 crocidolite, tremolite, and actinolite."

11 Do you see that?

12 A. That is what is written,
13 yes.

14 Q. That is the definition that
15 was recognized by Johnson & Johnson,
16 correct?

17 A. Yes. For those test
18 methods, yes. Yes.

19 Q. And that applies to Johnson
20 & Johnson Baby Powder and Shower to
21 Shower, correct?

22 A. Yes.

23 Q. Okay.

24 (Document marked for

1 identification as Exhibit

2 J&J-194.)

3 BY MR. PLACITELLA:

4 Q. 194 is the analysis of
5 powdered talc Test Method 7024 for
6 Johnson & Johnson baby products.

7 Do you see that?

8 A. I do, yes.

9 Q. For TEM. Okay.

10 And if you go to 7922, for
11 purposes of this specification, they
12 define what a fiber is, correct?

13 A. They do, yes.

14 Q. There's an elongated
15 particle with parallel sides and an
16 aspect ratio of greater than 3 to 1,
17 correct?

18 A. Yes. It says, "The
19 definition employed may vary with the
20 needs of the client." Yes.

21 Q. Okay. Now, what's -- now I
22 just want to talk to you a few minutes
23 about testing methods to determine
24 whether there was asbestos in the

1 Johnson & Johnson talc as defined by your
2 specification that we just went through.
3 Okay?

4 A. Yes.

5 Q. Okay. Now, a test method
6 involves a number of things. Would you
7 agree with that?

8 A. Yes.

9 Q. All right. It involves what
10 equipment you would use, correct?

11 A. Yes.

12 Q. It involves how the samples
13 are prepared, correct?

14 A. Yes. That's correct.

15 Q. It involves how much is
16 tested?

17 A. Yes.

18 Q. How often it's tested?

19 A. Yes.

20 Q. How the tests are carried
21 out?

22 A. Yes.

23 Q. What the output is, correct?

24 A. How do you mean -- how do

1 you define output?

2 Q. What the product is from the
3 test, whether it's a photomicrograph --

4 A. Okay, yes.

5 Q. -- diffraction patterning?

6 A. Yes.

7 Q. Right. And am I correct
8 that, generally speaking, no one size
9 fits all when it comes to test methods to
10 be used for finding asbestos in the
11 Johnson talc?

12 MR. BICKS: Objection to the
13 form.

14 THE WITNESS: Well, I'm
15 not -- I'm not quite sure I
16 understand the question.

17 BY MR. PLACITELLA:

18 Q. I'll rephrase it. Bad
19 question. Bad question.

20 A. Okay.

21 Q. Was one -- let's just focus
22 for a second on the equipment that was
23 used. A polarized light microscope was
24 used, correct?

1 A. It's one of the equipment,
2 yes, PLM.

3 Q. X-ray diffraction was
4 another?

5 A. X-ray diffraction with
6 selected area diffraction, yes.

7 Q. Okay. So what we are
8 talking about here, I borrowed this one
9 from Mr. Bicks again. We have up here on
10 this slide x-ray diffraction piece of
11 equipment, correct?

12 A. Yeah. That's an x-ray
13 diffractometer, yes.

14 Q. Right. Polarized light
15 microscope?

16 A. Yes.

17 Q. Right?

18 A. It is, yes.

19 Q. TEM?

20 A. Transmission electron
21 microscope, yes.

22 Q. Correct. All of those were
23 equipment that was used by Johnson &
24 Johnson or its consultants for testing

1 whether the Johnson & Johnson talc
2 contained asbestos, correct?

3 MR. BICKS: Objection to the
4 form.

5 THE WITNESS: Those -- those
6 items of equipment have been used
7 by J&J internally and by the
8 consultants to follow the method,
9 to confirm the absence of
10 asbestos, asbestos minerals in the
11 talc.

12 BY MR. PLACITELLA:

13 Q. Now, what are the, from your
14 perspective, well -- strike that.

15 What did Johnson & Johnson
16 consider the limitations to be for a
17 polarized light microscope using a
18 polarized light microscope in determining
19 whether there was a asbestos in the talc
20 samples that they were testing?

21 A. Okay. Let's step back a
22 point on that.

23 The test methodology J-4-1
24 required initially to use x-ray

1 diffraction. X-ray diffraction will pick
2 up amphibole if it's present or not.

3 Q. Excuse me. I didn't ask you
4 that. All right. Let's just stick to my
5 question.

6 My question was, what were
7 the limitations that were understood by
8 Johnson & Johnson in terms of the ability
9 of the polarized light microscope to find
10 asbestos in the talc specimens that were
11 being tested?

12 A. Okay. What I was trying to
13 explain was that you would not use
14 polarized light as the first port. You
15 would do it with x-ray diffraction first.

16 Q. I'm not asking that. That's
17 process.

18 A. Okay.

19 Q. I'm asking, what is the
20 limitation for that particular piece of
21 equipment and test? What can it not do?

22 MR. BICKS: Just if we can
23 refrain from interrupting the
24 witness.

1 MR. PLACITELLA: If the
2 witness would answer my question,
3 I wouldn't interrupt him.

4 THE WITNESS: My
5 understanding is that, assuming
6 that you've got a positive
7 indication of amphibole from x-ray
8 diffraction, you then go on to use
9 polarized light microscopy --
10 microscopy, and you would use high
11 magnification.

12 You would expect to see at
13 least -- at least .1 percent or
14 below for a level of assurance.

15 BY MR. PLACITELLA:

16 Q. So you couldn't use a
17 polarized light microscope as a first
18 level test for determining whether there
19 was asbestos in the talc that you were
20 testing, correct?

21 MR. BICKS: Objection to the
22 form.

23 THE WITNESS: No. To answer
24 your question, you'd have -- the

1 process requires that you use
2 x-ray diffraction as the first --
3 first test. And then if you've
4 got an indication, you then do
5 polarized light microscopy.

6 BY MR. PLACITELLA:

7 Q. Let me ask the question a
8 different way. If you use a polarized
9 light microscope alone, that would not be
10 definitive as to whether the talc sample
11 contained asbestos, correct?

12 A. Well, you wouldn't use it
13 alone.

14 Q. I'm asking you the question,
15 sir.

16 A. It's a hypothetical
17 question.

18 Q. It's not a hypothetical
19 question. I'm just asking you the
20 question.

21 If you took a sample and put
22 it under a polarized light microscope,
23 you could not tell by looking at that
24 sample without any other testing whether

1 that sample contained asbestos, correct?

2 MR. BICKS: Objection to the
3 hypothetical.

4 THE WITNESS: Again, I'm not
5 a microscopist. We ascertained
6 that a couple of hours ago. And
7 my understanding, speaking from my
8 knowledge, is that you would not
9 do that. You would not get an
10 answer just by doing polarized
11 light microscopy alone.

12 So to answer your question,
13 you wouldn't do that, and
14 therefore you wouldn't get that
15 answer.

16 BY MR. PLACITELLA:

17 Q. So a polarized light
18 microscope itself is not capable of
19 telling you whether what you're looking
20 at in that microscope contains asbestos,
21 fair?

22 MR. BICKS: Objection to the
23 form. Asked and answered.

24 THE WITNESS: It will tell

1 you. It depends on the quantity.
2 And that was the point that I was
3 trying to make. There will be a
4 level of quantification that a
5 polarized light microscope,
6 following on from x-ray
7 diffraction, will enable you to
8 get a quantification and a
9 qualitative identification as
10 well.

11 So I'm not -- you know, I
12 think you're asking the wrong
13 question. But it's a difficult
14 question to answer. On its own,
15 you would not -- you would not use
16 a polarized light microscope.

17 BY MR. PLACITELLA:

18 Q. If the only thing you had in
19 your laboratory was a polarized light
20 microscope, and you put a sample on it,
21 it's not going to give you the
22 information necessary to determine
23 whether there's asbestos in the talc,
24 right?

1 MR. BICKS: Objection to the
2 form. Asked and answered.

3 THE WITNESS: If -- if there
4 were a lot of asbestos, the answer
5 is it would find it. It would see
6 it. It depends on the quantity,
7 the amount.

8 BY MR. PLACITELLA:

9 Q. How much?

10 A. Again, I'm not a
11 microscopists. But a polarized light
12 microscope is -- some of them can be very
13 sophisticated, give a very high
14 magnification.

15 And if you have large
16 bundles of asbestos there, you could
17 quite easily see them and get
18 quantification. But on its own it's
19 not -- it's not the first choice. It's
20 not the first port of call.

21 Q. Okay. And what is the --
22 when it's used in conjunction with x-ray
23 diffraction, am I correct that the
24 detection limit is about 1 percent?

1 A. No. X-ray diffraction,
2 modern x-ray diffraction of selected area
3 of electron diffraction scanning will go
4 down to .1, .2 percent.

5 Q. No, sir, I'm asking you
6 polarized light microscope. The limit of
7 detection is about 1 percent, correct?

8 MR. BICKS: You said when it
9 was used with x-ray diffraction.

10 MR. PLACITELLA: After.

11 MR. BICKS: That was the
12 question that you asked.

13 MR. PLACITELLA: I'll
14 rephrase it so we're clear.

15 BY MR. PLACITELLA:

16 Q. The limit of detection on a
17 polarized light microscope is about 1
18 percent, correct?

19 A. Again, I don't want to
20 speculate. I'm not a microscopist. It's
21 probably that order between .1 and 1.

22 MR. BICKS: When you want to
23 take a break and have lunch, we're
24 fine to do that.

1 MR. PLACITELLA: Can you
2 give me 252.

3 (Document marked for
4 identification as Exhibit
5 J&J-252.)

6 BY MR. PLACITELLA:

7 Q. I tagged for you -- this is
8 a document provided to us in discovery,
9 J&J-252.

10 And I've -- if you opened to
11 the tagged page, it's a PowerPoint put
12 together by Rio Tinto. Who is Rio Tinto?

13 MR. BICKS: Can I have one
14 of them if you have --

15 MR. PLACITELLA: I only have
16 one. I'll take a break if you
17 want to look at it.

18 THE WITNESS: It is --
19 was -- it was still in existence,
20 the company that owned the
21 business before Luzenac.

22 BY MR. PLACITELLA:

23 Q. Okay. They were your
24 supplier?

1 A. They owned the mine after
2 Cyprus, yes.

3 Q. Okay. And according to this
4 PowerPoint, the detection limit for a PLM
5 or the polarized light microscope is
6 about 1 percent, correct?

7 A. That was the case when this
8 was written, which would have been, I
9 guess, the late 19 -- or early -- late
10 1980s. Yeah.

11 Q. Now, you mentioned
12 before --

13 MR. PLACITELLA: I don't
14 care. If you want to take a
15 break, that's fine. It's
16 1 o'clock. How long do you want
17 to take?

18 MR. BICKS: Do you want to
19 come back. It's 10 to 1:00 --
20 1:30?

21 MR. PLACITELLA: 1:30 is
22 fine.

23 THE WITNESS: Yeah, sounds
24 good. Whatever you want.

1 THE VIDEOGRAPHER: Okay.
2 Stand by, please. The time is
3 12:52 p.m. Going off the record.

4 - - -
5 (Lunch break.)

6 - - -
7 THE VIDEOGRAPHER: We are
8 back on the record. The time is
9 1:32 p.m.

10 - - -
11 EXAMINATION (Cont'd.)

12 - - -

13 BY MR. PLACITELLA:

14 Q. Okay. I handed you
15 Hopkins-3, which was the list we went
16 over, the handwritten list before.

17 (Document marked for
18 identification as Exhibit
19 Hopkins-3.)

20 BY MR. PLACITELLA:

21 Q. As I understand it, that was
22 to the best of your recollection, but
23 you've reserved the right to look at it
24 overnight and see if the numbers are

1 correct?

2 A. Yes.

3 Q. Correct?

4 A. Yes.

5 Q. Okay. I want to talk now
6 about x-ray diffraction.

7 MR. PLACITELLA: Give me
8 154.

9 (Document marked for
10 identification as Exhibit
11 J&J-154.)

12 BY MR. PLACITELLA:

13 Q. The Colorado School of Mines
14 was a consultant to Johnson & Johnson on
15 the issue of asbestos testing in the
16 Johnson & Johnson talc, correct?

17 A. Yes. This was back in 1971.
18 Yes.

19 Q. What I have given you is
20 marked as Exhibit 154, is an August 3rd,
21 1971 memo generated by the Colorado
22 School of Mine, and the subject is "X-ray
23 Investigation."

24 Do you see that?

1 A. Yes.

2 Q. Okay.

3 A. Yes.

4 Q. And we're -- go to the last
5 paragraph. In this last paragraph, the
6 Colorado School of Mines indicates that
7 the limit of detection for the x-ray
8 diffraction is about 1 percent for
9 fibrous materials, correct?

10 MR. BICKS: It says the
11 limit of recognition.

12 BY MR. PLACITELLA:

13 Q. Limit of recognition of
14 constituents is probably on the order of
15 1 percent for fibrous materials, correct?

16 A. That's what was written.
17 And that was probably the case in 1971.

18 (Document marked for
19 identification as Exhibit
20 J&J-35.)

21 BY MR. PLACITELLA:

22 Q. I'm showing you what's been
23 marked as Exhibit 35.

24 This is a 1972 document

1 generated by the Colorado School of
2 Mines. And it went to a Dr. Al Goudie in
3 Edison, New Jersey. Who is he?

4 A. He was a research director
5 in the baby products company.

6 Q. Okay. For Johnson &
7 Johnson?

8 A. For Johnson & Johnson, yes.

9 Q. Right. And according --
10 MR. SILVER: Chris, the
11 Bates number?

12 MR. PLACITELLA: Oh, yeah.
13 The Bates number is
14 JNJL61-50714 -- no, 7139 it would
15 be.

16 BY MR. PLACITELLA:

17 Q. And what the Colorado School
18 of Mines tells Johnson & Johnson is that
19 x-ray diffraction can tell if the sample
20 contains serpentine, but it can't tell
21 whether it contains chrysotile, correct?

22 A. Yes, that's what he's
23 written, yes.

24 Q. Okay. And who -- by the

1 way, do you know who Rich Zazenski is?

2 A. He was employed by Luzenac
3 back in the 1990s, as I recollect.

4 Q. Okay. What was his job, if
5 you know?

6 A. I have met him. Let me
7 think. He was -- he was involved in
8 research R&D.

9 Q. Okay. Somebody with
10 knowledge of testing methods?

11 A. I wouldn't know that level
12 of detail. I did meet him once.

13 Q. And Luzenac was your
14 supplier of talc in the '90s, and into
15 the 2000s? I'm not allowed to go beyond
16 2006.

17 A. Yeah, Luzenac was the
18 supplier who owned the mine in Vermont up
19 until it was -- became Imerys.

20 Q. And they were testing the
21 talc that was sold to Johnson & Johnson
22 for asbestos content, correct?

23 A. That would have been part of
24 their responsibility, yes.

1 (Document marked for
2 identification as Exhibit
3 J&J-224.)

4 BY MR. PLACITELLA:

5 Q. Let me show you 224. Now,
6 you had -- 224 is a correspondence from
7 Donna Dennis to Rich Zazenski. Do you
8 know who Donna Dennis is?

9 MR. SILVER: Chris, I'm
10 sorry.

11 MR. PLACITELLA: I'll get
12 it. I'll get to it.

13 THE WITNESS: No, I do not
14 know. No, I've not met that name,
15 seen that name. It looks like --

16 MR. BICKS: You said it's
17 from Donna Dennis.

18 MR. PLACITELLA: I'm sorry.
19 You're correct. From Zazenski to
20 Donna Dennis.

21 BY MR. PLACITELLA:

22 Q. And here Zazenski states --
23 he's talking about the specification for
24 testing asbestos using TEM.

1 Do you see that?

2 A. Yes.

3 Q. And he states that everyone
4 in the company recognizes that XRD, PCM
5 and PLM are simply not sensitive enough
6 to provide complete assurance that the
7 talc is free of detectable asbestos,
8 correct?

9 MR. BICKS: Objection to the
10 form.

11 THE WITNESS: Yeah, what he
12 states, "I think we all recognize
13 that XRD, PCM and PLM are simply
14 not sensitive enough to provide
15 complete assurance that talc is
16 free of detectable asbestos."

17 BY MR. PLACITELLA:

18 Q. And that was known and
19 understood by Johnson & Johnson at the
20 time, correct?

21 A. Yeah. And that's why they
22 had been using TEM since 1972, '73 time
23 frame.

24 Q. That was known -- XRD, PCM

1 and PLM, it was known by Johnson &
2 Johnson that it wasn't sensitive enough
3 to provide complete assurance that the
4 talc is free of detectable asbestos,
5 true?

6 MR. LOCKE: Objection.

7 THE WITNESS: You read what
8 Mr. Zazenski wrote in 2001.

9 He made that statement that
10 it is not simply enough to
11 detect -- to provide complete
12 assurance that the talc is free
13 from detectable asbestos.

14 BY MR. PLACITELLA:

15 Q. And Johnson & Johnson
16 understood that to be the case, correct?

17 A. Yes, and as I said, that's
18 why since 1972-3 time frame, Johnson &
19 Johnson had used TEM as part of the
20 process.

21 Q. Sir, did I ask you about
22 TEM?

23 A. No.

24 Q. I'll repeat my question.

1 A. No, no --

2 Q. Johnson & Johnson understood
3 from 1972 forward that XRD, PCM, and PLM
4 was not sensitive enough to provide
5 complete assurance that talc is free from
6 detectable asbestos. True or false?

7 MR. BICKS: Objection to the
8 form of the question.

9 THE WITNESS: Well, you read
10 what Mr. Zazenski wrote. And I
11 would agree that Johnson & Johnson
12 was of the opinion that those test
13 methods on their own would not be
14 necessarily sensitive enough to
15 provide complete assurance that
16 the talc is free from detectable
17 asbestos.

18 BY MR. PLACITELLA:

19 Q. Thank you. Now, you just
20 mentioned TEM. So I want to talk about
21 that for a second.

22 MR. PLACITELLA: Can you
23 give me or does he have 234.

24 (Document marked for

1 identification as Exhibit

2 J&J-234.)

3 BY MR. PLACITELLA:

4 Q. Do you have 234 there
5 already? I think you do.

6 234 is a PowerPoint for the
7 development of a new ASTM method for the
8 analysis of cosmetic and pharmaceutical
9 talc for asbestos. Do you see that?

10 A. That is the title of this
11 PowerPoint, yes.

12 Q. And it's authored in part by
13 Julie Pier who worked for one of your
14 suppliers correct?

15 A. Yes.

16 MR. BICKS: Can I just --
17 because it doesn't have Bates
18 stamps on it, do you know where
19 this came from?

20 MR. PLACITELLA: Not as I
21 sit here.

22 BY MR. PLACITELLA:

23 Q. Now, if you go to where I
24 tabbed for you, "TEM option method

1 highlights"?

2 A. I see that.

3 Q. Okay. She states, "TEM is
4 definitive for chrysotile versus
5 non-asbestiform serpentine, not
6 necessarily definitive for
7 amphibole-asbestos versus amphibole
8 cleavage fragments."

9 Do you understand that to be
10 the case?

11 MR. SILVER: Objection to
12 form.

13 BY MR. PLACITELLA:

14 Q. Did Johnson & Johnson
15 understand that to be the case?

16 MR. BICKS: No foundation.

17 MR. SILVER: Objection.

18 THE WITNESS: This is
19 something that a microscopist
20 contributed to.

21 I don't know if she was the
22 only person who contributed.
23 There were other mineral people
24 there.

1 So do Johnson & Johnson
2 accept that's the case? To be
3 honest, I don't -- I don't know if
4 they would accept that's the case.

5 Johnson & Johnson takes its
6 lead from experts in microscopy
7 and microanalysis. And certainly
8 the author would have expertise
9 that would not necessarily be
10 present in Johnson & Johnson.

11 So it's a reasonable
12 statement I think that she's made
13 or he's made, whoever wrote this.

14 BY MR. PLACITELLA:

15 Q. Did Johnson & Johnson
16 understand that TEM was definitive in
17 terms of testing for chrysotile, but not
18 necessarily definitive for amphibole
19 testing?

20 MR. BICKS: Objection to the
21 form. No foundation.

22 THE WITNESS: Again, I'm not
23 an expert in that particular
24 field. It is a statement that's

1 made on a PowerPoint presentation.

2 Whether or not Johnson &
3 Johnson had that inhouse expertise
4 to agree or disagree is something
5 that I just don't have the answer
6 to.

7 BY MR. PLACITELLA:

8 Q. Okay. Well, you're the
9 person that has the most knowledge,
10 everybody all rolled up into one.

11 MR. BICKS: Objection to the
12 form.

13 BY MR. PLACITELLA:

14 Q. So you don't know. That
15 means that Johnson & Johnson doesn't
16 know?

17 A. No, what I'm saying is there
18 are areas of expertise that the company
19 buys in and wherever it's needed. And in
20 this particular case, if we are looking
21 at analysis of talc using transmission
22 electron microscopy, the company uses
23 outside experts with a great skill set
24 and many, many years of experience and

1 expertise. And the results of that
2 expertise becomes part of Johnson &
3 Johnson's opinion as to whether or not
4 the product contains asbestos or not.

5 Q. As you sit here today, you
6 can't say one way or the other whether
7 Johnson & Johnson knows whether TEM is
8 definitive for finding amphibole fiber in
9 its talc?

10 MR. BICKS: Asked and
11 answered.

12 THE WITNESS: Again, I
13 cannot say, because I'm not a
14 microscopy expert. And we
15 ascertained that a couple of hours
16 ago, that I don't claim to be.

17 And the expertise, if you
18 like, has always been outside of
19 the company in this area where
20 we're looking at very
21 sophisticated techniques and
22 ongoing research. This is dated
23 2011, which someone has made this
24 comment. And it's a comment

1 that's being made in a PowerPoint
2 presentation. I'm not in a
3 position to agree or to disagree.

4 BY MR. PLACITELLA:

5 Q. Well, you told me that
6 you've been using TEM since 1972,
7 correct?

8 A. The company has been using
9 TEM in the '72-'73 time frame.

10 Q. And although you've been
11 using it since 1972, you don't know
12 whether TEM is capable of finding
13 amphibole asbestos in its talc --

14 A. No, that --

15 Q. -- in Johnson & Johnson
16 talc?

17 A. That's not true. The -- the
18 companies who have done the TEM testing,
19 people like McCrone, RJ Lee, EMB
20 Associates. Those people have their own
21 inhouse skill sets and people who will
22 give a definitive answer as to whether or
23 not asbestos is present.

24 Q. But, sir, the specification

1 for testing your talc is a Johnson &
2 Johnson specification, correct?

3 A. Yes.

4 Q. And you specify that TEM is
5 one of the test methods that should be
6 used, correct?

7 A. Correct.

8 Q. But you have nobody at
9 Johnson & Johnson that knows what the
10 limitations are of TEM in terms of
11 testing for amphibole asbestos? Is that
12 what you're saying?

13 A. No, I'm not saying that at
14 all.

15 There was a lady who retired
16 not that long ago, Ms. Gallagher, who was
17 an expert in this area, inhouse. And she
18 had a skill set to understand the results
19 of this. And to understand the
20 capabilities otherwise of TEM.

21 So there are people that
22 have got that expertise inhouse or had
23 that expertise inhouse.

24 Q. Yeah, but you're here to

1 talk on behalf of the company. You're
2 supposed to be addressing this issue.
3 And what I'm asking you is, as you sit
4 here as a representative of Johnson &
5 Johnson, are you able to say one way or
6 the other whether TEM is capable to
7 definitively find amphibole asbestos in
8 your talc?

9 MR. BICKS: I just also
10 object as that's not really a fair
11 characterization of what he's here
12 to talk about, that you just
13 described it, as your notice
14 defines it. And you've made a big
15 deal in the beginning pointing out
16 that he's not an expert.

17 MR. PLACITELLA: Is this a
18 speaking objection or --

19 MR. BICKS: Well, but it's
20 just --

21 MR. PLACITELLA: It's not a
22 form objection. So I'm trying to
23 understand what you're doing. If
24 you want to testify, why don't you

1 just switch seats.

2 MR. BICKS: I don't want to
3 testify. But I want it to be
4 fair.

5 MR. PLACITELLA: I'm being
6 fair.

7 MR. BICKS: I don't want you
8 to --

9 MR. PLACITELLA: I'm not the
10 one who brought up TEM. He did.

11 MR. BICKS: -- skate all
12 over the space.

13 MR. PLACITELLA: I'm not
14 spraying it all over the place.

15 BY MR. PLACITELLA:

16 Q. Sir, as you sit here today,
17 as a representative of Johnson & Johnson,
18 is it your testimony that Johnson &
19 Johnson does not know whether the TEM
20 method that it specified for testing its
21 talc is capable of definitively
22 determining whether the talc contained
23 amphibole asbestos?

24 A. To answer your question, no

1 that is not Johnson & Johnson's position.
2 The position has always been that TEM was
3 capable of detecting asbestiform --
4 asbestiform amphibole asbestos.

5 Q. Including amphibole
6 asbestos?

7 A. Yeah. Well, that's what I
8 said. Amphibole asbestos.

9 Q. At any level?

10 A. TEM will go down to the
11 parts per million level, 10 parts per
12 million. In fact, some of the modern TEM
13 is capable of going down to the parts per
14 billion level.

15 Q. So Johnson & Johnson
16 disagrees with Julie Pier when she says
17 that TEM is not definitive for
18 determining whether there's amphibole
19 asbestos in a sample?

20 MR. BICKS: This is not --

21 MR. SILVER: Objection to
22 form.

23 MR. BICKS: It says not
24 necessarily --

1 BY MR. PLACITELLA:

2 Q. Correct?

3 A. I was going to say that.
4 What was written in this -- and we're
5 looking at, probably what would have
6 probably been a two-hour presentation,
7 PowerPoint presentation. And you've
8 selected out two lines.

9 And what -- what is
10 highlighted here was not necessarily
11 definitive for amphibole asbestos versus
12 amphibole cleavage fragments.

13 And the point I made is that
14 Johnson & Johnson's position has always
15 been that TEM was capable of detecting
16 amphibole asbestos where it be present.

17 Q. So why bother with XRD?

18 A. It's a history that when the
19 test methods were being developed back in
20 the early 1970s, you look at XRD as step
21 one. And you get a big picture. You
22 have a larger sample of material. You
23 get a big picture of the -- of the talc.
24 You can look at about 100,000 particles.

1 And you get the big picture. Then you
2 focus down through polarized light, and
3 then through transmission microscopy. So
4 you look at all three. It's a belt and
5 suspenders approach.

6 Q. Sir, you're aware, are you
7 not, that your own specifications state
8 that for certain sampling procedures you
9 don't use TEM, you only use XRD? You
10 know that, correct?

11 A. The -- that's not entirely
12 true.

13 The requirements of the ore
14 testing is TEM. That's the first part.
15 When you're testing the ore.

16 When you go on to test the
17 floated product, you look at XRD and PLM
18 if necessary. And then there's a backup,
19 a Level 3 protocol, where you look at TEM
20 on the finished product on a regular
21 basis.

22 Q. Well, if we have time we'll
23 do some more of that. But as we sit
24 here, the -- you understand that the

1 detection limit for TEM for chrysotile
2 was about .001 percent by weight?

3 MR. BICKS: Objection to the
4 form. No foundation.

5 MR. PLACITELLA: Give me
6 182.

7 (Document marked for
8 identification as Exhibit
9 J&J-182.)

10 MR. BICKS: And vague as to
11 time.

12 BY MR. PLACITELLA:

13 Q. You have in front of you
14 Exhibit 182 which is a January 1976 --

15 A. '86.

16 Q. -- '86 letter.

17 A. Hang on.

18 MR. BICKS: This is
19 April 1986, what we have.

20 MR. PLACITELLA: No. Do you
21 have 182?

22 MR. BICKS: Right.

23 THE WITNESS: Yes.

24 MR. PLACITELLA: Look at the

1 second page. Here's the second
2 page. They're attached.

3 MR. SILVER: The Bates
4 number?

5 MR. PLACITELLA: That's
6 right. Bates number. There must
7 have -- I don't know. There is no
8 Bates number.

9 BY MR. PLACITELLA:

10 Q. The April 29, 1986, do you
11 see that?

12 MR. BICKS: I think it's
13 '87, right?

14 MR. PLACITELLA: It says
15 April 29, 1986.

16 MR. BICKS: Yeah, but look
17 when it's received. Because you
18 can see there's a typo on what
19 we've got here. Or are you on the
20 second page?

21 MR. PLACITELLA: I'm on the
22 first page.

23 BY MR. PLACITELLA:

24 Q. Do you see that? We are --

1 let me see yours. We are on the same
2 page. April 29, 1986.

3 A. Yes.

4 Q. Are you with me?

5 A. Yes.

6 Q. Okay. And you go to the
7 second page of that document, which is
8 January 28th, from McCrone.

9 A. Yes, that was nine months
10 later.

11 Q. Right. And you see where
12 McCrone says the limit of detection is
13 .001 --

14 MR. SILVER: Objection.

15 BY MR. PLACITELLA:

16 Q. -- weight percent?

17 A. That's what they've written
18 in that particular case. It was below
19 .001 percent by weight.

20 Q. Right. That's the limit of
21 detection. That's what it states,
22 correct?

23 A. That's what they stated in
24 1987.

1 Q. Right. And you have
2 testified, have you not, that at
3 .001 percent you could still have
4 millions of fibers per gram?

5 A. I don't recollect testifying
6 that you could still have millions of
7 fibers per gram. But what we've got here
8 is the limited detection on that
9 particular time frame, they claim to be
10 .001 percent by weight.

11 Q. Sir, you understand that
12 even at .001, could still be millions of
13 fibers per gram, correct?

14 A. If they were present you
15 would still have fibers, yes. If they
16 were present. But as I say, they found
17 no quantifiable amounts.

18 Q. But I'm talking in general.
19 Even at .001 or below, you could have
20 millions of fibers per gram, correct?

21 A. Well, it's -- I'm not going
22 to speculate because you need to see this
23 in the context of other test methods that
24 were being used. That's what -- that's

1 the point I make.

2 Q. Sir, did you testify under
3 oath in a trial that at .001 percent, you
4 could still have millions of fibers per
5 gram of asbestos fibers?

6 A. If they were there, if they
7 were present, in theory, you could. If
8 they were there.

9 MR. PLACITELLA: Now, give
10 me 159.

11 (Document marked for
12 identification as Exhibit
13 J&J-159.)

14 BY MR. PLACITELLA:

15 Q. I'm going to show you what's
16 been marked 159. This is a February 23,
17 1978, Johnson & Johnson document,
18 correct?

19 A. Yes, it is. Yes.

20 Q. Okay. If you go to Page 2,
21 it talks about the sampling that's being
22 done.

23 Do you see that?

24 A. Yes.

1 Q. And it talks about the
2 ground ore being testified -- being
3 tested by TEM, correct?

4 A. That is -- yes. 7024 is
5 TEM. Yes.

6 Q. Right. And it talks about
7 the composite samples being tested for by
8 the J-4-1 method and the 7019 method,
9 correct?

10 A. Yes.

11 Q. Okay. The composite samples
12 it doesn't state that you were using TEM,
13 does it?

14 A. Not -- not on those
15 composite samples at that point, no.

16 Q. Okay.

17 A. The flash dry is tested
18 later.

19 Q. All right. And according to
20 your requirements underneath, it says the
21 J-4-1 method was for finding fibrous
22 amphibole forms, correct?

23 A. Yes.

24 Q. But that had a limit of

1 .5 percent, correct? We went over that.

2 A. Yeah, around about 70, 80,
3 it was around that point in time. .1, to
4 .2 with more modern equipment.

5 Q. And 7019 was for determining
6 whether there was serpentine minerals,
7 correct?

8 A. That's a differential
9 thermal analysis, yes.

10 Q. Right. It could not tell,
11 7019, whether the serpentine materials
12 was asbestos or not, correct?

13 A. It would pick up serpentine
14 material at .5 percent.

15 Q. And underneath it where it
16 says "asbestiform minerals," you list
17 your spec for 7024, correct?

18 A. Yes.

19 Q. All right. So when you were
20 testing the weekly composites according
21 -- at least at this time, according to
22 this document, you were not using
23 electron microscopes, were you?

24 A. No, it was the biweekly

1 composites that were using electron TEM.

2 Yes.

3 Q. Twice a month, you would use
4 the TEM on ore, correct?

5 A. Right. There's a little bit
6 of detail on that. The --

7 Q. Is that what it says, sir?
8 Does it say that twice a month you would
9 be using the TEM on the ore?

10 MR. BICKS: Ground ore.

11 BY MR. PLACITELLA:

12 Q. On the ground ore?

13 A. The ground ore. But that is
14 a composite of samples taken on a regular
15 basis during the manufacturing shift each
16 day, day after day, and they are mixed
17 combined together. And then that
18 composite sample is evaluated every two
19 weeks.

20 Q. Correct.

21 A. So -- but it is on data
22 production runs for that two-week period,
23 then it's mixed together, and then
24 evaluated every two weeks by TEM.

1 Q. So you use TEM to look at
2 the ore, correct?

3 A. Yes.

4 Q. All right. You use XRD to
5 look at the flash-dried talc, the
6 finished product, right? That's what
7 this says?

8 A. J-4-1 is XRD followed, if
9 there is an indication of amphibole, by
10 polarized light. And then in this case
11 followed by TM 7019, which is
12 differential thermal analysis.

13 Q. Right. So when you're
14 looking at the weekly composites of the
15 finished product, you don't use a method
16 that can find chrysotile asbestos, do
17 you?

18 MR. BICKS: Just so -- when
19 you keep saying "we," you're
20 talking about Windsor here as
21 distinct from Johnson & Johnson.

22 MR. PLACITELLA: Well, this
23 is a Johnson & Johnson
24 specification, isn't it?

1 MR. BICKS: No.

2 MR. PLACITELLA: Could you
3 please not do that? You know, to
4 be fair.

5 BY MR. PLACITELLA:

6 Q. Okay. So let me just go
7 further.

8 Let's go down to the next
9 page. Do you see where it talks about
10 standard test method.

11 A. Have we turned the page?

12 Q. The next page, sir.

13 A. Yes.

14 Q. And that is a standard test
15 method by Johnson & Johnson Baby products
16 company and it lists 7019 as the method,
17 correct?

18 A. That was the differential
19 thermal analysis, DTA, that was used in
20 1977 there. Yes.

21 Q. Right. And what they did
22 there, is they -- part of the process is
23 where they actually heated the sample up,
24 right?

1 A. Yes. DTA requires you to
2 heat the sample, cool it, and measure
3 certain changes through an instrument
4 that will tell you whether or not you
5 have serpentine minerals present.

6 Q. Right. This is not TEM,
7 correct?

8 A. No. This is DTA.

9 Q. Okay. And if you look a
10 little bit further down. And I'll blow
11 it up.

12 It states that you can use
13 this method to detect the presence of
14 serpentine material, including chrysotile
15 asbestos, correct?

16 A. Yes.

17 Q. That's what it says?

18 A. It does, yes.

19 Q. Okay. And then when it says
20 interferences, it talks about what's
21 going to interfere with finding trace
22 levels, correct?

23 A. Yeah, what it says is, "No
24 mineral is commonly found as trace

1 contaminants in cosmetic talc are known
2 to exhibit thermal transitions," which
3 would interfere with the detection of a
4 serpentine mineral by DTA.

5 Q. Right. And then if you go
6 to the next page where it goes to
7 sensitivity, it says that the sensitivity
8 is .5 percent, correct?

9 A. Yes. That's -- that's
10 correct.

11 Q. So you are not going to even
12 find serpentine using this method under
13 .5 percent, correct?

14 A. That method on its own, no.
15 You'd -- you had done your x-ray
16 diffraction to see if you have an
17 amphibole mineral. That would exclude
18 the tremolite type. And with the TEM,
19 you then look at -- you need to do the
20 TEM part to see if you've got a
21 serpentine.

22 Q. All right. And what it says
23 here, "This method is not specific as to
24 any variety of serpentine mineral, that

1 is, whether it's antigorite chrysotile or
2 lizardite," correct?

3 A. That's what it says.

4 Q. So you can't use this method
5 to determine whether the talc sample
6 contains chrysotile, correct? It won't
7 tell you?

8 A. Well, that's not entirely
9 true. If it contained chrysotile it
10 would pick it up as a serpentine mineral.
11 You might get a false positive if it
12 didn't contain chrysotile but contained
13 some antigorite.

14 Q. Right. You can't tell the
15 difference?

16 A. You'd get a false positive.

17 Q. Right. So you can't rely
18 upon this method to tell you whether you
19 have chrysotile in the sample, correct,
20 alone?

21 A. No. If there's chrysotile
22 present, the method would pick it up.
23 What the method -- what the author said
24 in terms of sensitivity, is if there were

1 antigorite present, it would also pick it
2 up. But it would still pick it up if
3 there were chrysotile present.

4 Q. And it can tell the
5 difference between chrysotile and
6 antigorite?

7 A. No, but --

8 Q. That's my point. My point
9 here is that you can't use this method to
10 definitively find chrysotile, because you
11 won't know whether it's chrysotile,
12 antigorite, or lizardite, if they are all
13 present, correct?

14 A. I'll try and say that again.
15 If there were chrysotile there, it would
16 pick it up. But also it would also pick
17 it up, if it were present, antigorite or
18 lizardite. That's what they're --

19 Q. And if there are all three,
20 it can't tell you what is present, right?

21 A. But it would show that --
22 well, if they are there. If you were
23 looking for chrysotile and you got a
24 positive response with this method, it

1 would flag up that there was a serpentine
2 there, which could include chrysotile.

3 Q. This states, "This method is
4 not" -- I don't want to fight with you.

5 "This method is not specific
6 as to the variety of serpentine mineral
7 present?" Does it state that?

8 A. It does.

9 Q. Okay. So now, going back to
10 the page, two pages before. According to
11 this letter from Johnson & Johnson,
12 Mr. Lee, who you told me was a senior
13 scientist, correct?

14 A. That's correct, yes.

15 Q. Okay. According to this
16 letter, TEM, which you say is definitive
17 for determining whether there is asbestos
18 in talc, is never used, according to this
19 letter, on the finished product, correct?

20 MR. BICKS: Objection to the
21 form.

22 THE WITNESS: According to
23 that letter, that would be the
24 inference.

1 But what I did tell you is
2 that there is what I call a belts
3 and suspenders approach whereby --

4 BY MR. PLACITELLA:

5 Q. Sir -- sir --

6 A. -- TEM is used --

7 Q. Sir, I'm asking you what's
8 reflected in this letter, not your
9 opinions. Remember when we started
10 saying I said I didn't want your
11 opinions. I wanted the facts. Okay.
12 And unless you have some contemporaneous
13 document to document what you're saying,
14 let's stick to the facts.

15 According to this letter --

16 MR. LOCKE: Objection.

17 BY MR. PLACITELLA:

18 Q. According to this letter,
19 TEM is not used to test the finished
20 product, correct?

21 MR. BICKS: Objection to the
22 form.

23 THE WITNESS: It is used to
24 test the ground ore but not the

1 ore after it's been washed and
2 dried.

3 MR. PLACITELLA: Okay.

4 Let's go to 194.

5 BY MR. PLACITELLA:

6 Q. 194 is the specification we
7 went through before for TEM, correct?

8 A. Yes.

9 Q. Okay. And if you go to
10 Page 3 under sample preparation, we said
11 that was part of methodology?

12 A. Yes, that's correct.

13 Q. It says you take, in order
14 to prepare the sample, 30 to
15 50 milligrams of talc powder to start,
16 correct?

17 A. Yes. That's what's written.

18 Q. That is very, very little,
19 correct?

20 A. It's a small sample, yes.

21 Q. Okay. Like, I don't know,
22 could you even see it if I put it under
23 the Elmo here, 30 to 50 milligrams?

24 A. Oh, yeah.

1 Q. You could?

2 A. Yeah.

3 Q. So can you go to Page 5.

4 When it talks about calculating the
5 detect -- calculation of a detection
6 limit.

7 Do you see that?

8 A. I do.

9 Q. It says a minimum
10 quantifiable mass of asbestos fibers
11 based upon the detection of five fibers.

12 Do you see that?

13 A. Yes.

14 Q. So until you hit -- even if
15 you see fibers, until you hit five fibers
16 according to this method, it's not
17 quantifiable, correct?

18 A. The term "quantifiable"
19 means what weight, what percent, et
20 cetera. And what it -- if you saw one
21 fiber, you'd say, "I've seen one fiber."
22 I've seen two fibers. But to get a
23 quantity, a quantifiable amount in
24 percent, .0001 percent, what it says is

1 that you would need to see five fibers,
2 knowing how much you put under your
3 microscope.

4 Q. All right. So in order to
5 say you found asbestos, you'd have at
6 least five fibers of one type, correct?

7 A. No. Quantifiable, as I
8 said, relates to how do you create a
9 percentage. How do you say it's .0001
10 percent. You need five fibers to do that
11 math.

12 But you will certainly see
13 one fiber under the -- under the
14 microscope, and you would report if you
15 saw one fiber.

16 Q. So you would put in the
17 report that you saw one fiber, even if it
18 was not quantifiable? That's what you'd
19 put in the report?

20 MR. BICKS: Objection to the
21 form.

22 Who is the "you" here?

23 MR. PLACITELLA: Johnson &
24 Johnson.

1 THE WITNESS: The facilities
2 that have done the testing have
3 always reported if they found a
4 fiber, even one fiber.

5 This is a separate question
6 as to whether you can quantify it
7 in terms of percentages.

8 And to do that, the math of
9 this is that you'd need to see
10 five fibers based on the amount
11 that you had used your
12 50 milligrams to get a percentage
13 number. But you can certainly see
14 one fiber under the TEM.

15 BY MR. PLACITELLA:

16 Q. So what happens if you find
17 four fibers of tremolite, four fibers of
18 actinolite. Four fibers of chrysotile.
19 And four fibers of something else?

20 As long as it doesn't hit
21 five fibers, you can have up to 16, 20
22 fibers as long as you don't hit the
23 number five, you can say it's not
24 quantifiable?

1 MR. BICKS: Objection to
2 form.

3 THE WITNESS: No, no, that's
4 not true. It uses a generic term,
5 "quantifiable mass of asbestos
6 fibers."

7 BY MR. PLACITELLA:

8 Q. So you can mix and match?

9 A. If there were -- if there
10 were -- that's what this document reads.
11 That if in theory you had actinolite or
12 for a -- a serpentine fiber, you'd count
13 that, whether it was four, five, six,
14 whatever. You'd still count them with
15 that number.

16 Q. So as soon as you hit five,
17 no matter what the fibers were, you would
18 say it was quantifiable?

19 MR. BICKS: Asked and
20 answered.

21 THE WITNESS: If they were
22 asbestos fibers --

23 BY MR. PLACITELLA:

24 Q. Right.

1 A. -- you could quantify it in
2 terms of percentage knowing that the
3 figure started with the 50 milligrams
4 that would allow you to work out a
5 percentage. But you'd still see, even if
6 it was just one asbestos fiber there, you
7 would still see it with transmission
8 microscopy.

9 MR. PLACITELLA: Okay. Now,
10 get me 198.

11 (Document marked for
12 identification as Exhibit
13 J&J-198.)

14 BY MR. PLACITELLA:

15 Q. I've shown you Exhibit 198
16 which is a November 26, 1990 letter from
17 McCrone to Windsor Chemical -- Windsor
18 Minerals. And in here, McCrone states
19 that they found no quantifiable amounts
20 of asbestiform minerals.

21 Do you see that?

22 A. Yes.

23 Q. How many fibers did they
24 report here?

1 A. I haven't read this report.

2 Q. Well, right here on this
3 letter, how many fibers are they
4 reporting? I mean, wouldn't the
5 layperson look at this and say there's no
6 asbestos?

7 A. It says we found no
8 quantifiable amounts.

9 Q. Right. So how many fibers
10 did they find here and what kind?

11 A. Well, based on that first
12 page, it doesn't give the answer to your
13 question. You'd need to read the whole
14 report, or at least I would need to read
15 the whole report.

16 Q. Go to Bates Number 7797.

17 A. Yes.

18 Q. Here it says they found
19 anthophyllite?

20 A. Anthophyllite usually occurs
21 in its non-asbestos form.

22 Q. But does it say that?

23 A. Well, no, but they phrased
24 it differently. They found no

1 asbestiform minerals.

2 Q. Where -- where does it say
3 no asbestiform?

4 A. Page --

5 Q. I thought it said -- can you
6 just look at this for a second. If it's
7 a fiber, then it's asbestiform, right,
8 sir?

9 A. Usually, yes. Unless -- it
10 depends on how we're defining fiber.

11 Q. So do you see the part where
12 in notes it says "fibers"? I blew it up.

13 A. I can see the word "fibers,"
14 but I can't read the second word.

15 Q. Okay. And do you see on
16 that same page they found anthophyllite?

17 A. Yes.

18 Q. Okay. That's not reported
19 on this page, is it?

20 A. Well, they claim not to have
21 found any asbestos.

22 Q. Well, no. It says, "We
23 found no quantifiable amounts of
24 asbestiform." But they found

1 anthophyllite, correct?

2 A. They found anthophyllite.
3 But from that, without more detail and
4 without more information, it doesn't tell
5 us whether they were an asbestiform.

6 Q. Yeah, sure, it does. It
7 says fibers, right? Somebody didn't make
8 that up. Let's go to another one. How
9 about --

10 MR. BICKS: Can I just make
11 sure I see this right?

12 MR. PLACITELLA: No.

13 MR. BICKS: No, no, hold on
14 a minute. This is the exhibit
15 that you just put in front of him.

16 MR. PLACITELLA: Mm-hmm.

17 MR. BICKS: And you're
18 suggesting that that attachment
19 that you're reading that chart is
20 part of this letter dated
21 November 26th.

22 MR. PLACITELLA: I'm not
23 saying it's part. I'm not saying
24 it's part of it. All right.

1 Let's go back.

2 BY MR. PLACITELLA:

3 Q. Do you see the numbers here?

4 MR. BICKS: Because the
5 enclosure is with a different
6 document.

7 MR. PLACITELLA: 9028, 9029,
8 9030.

9 THE WITNESS: That says
10 client ID. The client has to be
11 Windsor Minerals or Cyprus
12 Minerals.

13 BY MR. PLACITELLA:

14 Q. All right. Do you see here
15 where it's the same numbers, 90, 90 and
16 90, September 1990?

17 MR. BICKS: That's the year.

18 BY MR. PLACITELLA:

19 Q. CWM 90, 28, 29 and 30. 28,
20 29 and 30, correct?

21 A. Correct. What it doesn't
22 tell us is what this is. Cyprus Minerals
23 had a major manufacturing operation for
24 industrial talcs. That's nothing here

1 that says this is Johnson's Baby Powder
2 talc.

3 Q. I didn't ask you that
4 question, sir?

5 A. It's giving a designation.

6 Q. Does -- by the way, can you
7 go to 7803?

8 A. Yes.

9 Q. Here they find chrysotile?

10 A. They reported a chrysotile
11 fiber, yes.

12 Q. Okay. Is that reported by
13 McCrone in their report?

14 A. On this report, no. But
15 again, what is this to do with Johnson's
16 Baby Powder?

17 Q. Well, you tell me, sir.

18 A. Well, what I can tell you is
19 that Cyprus Minerals when they took over
20 the operation from Windsor Minerals,
21 carried on mining and manufacturing
22 industrial talcs, which were quite
23 separate from the talcs that were used in
24 Baby Powder. And the point I'm making is

1 that without proper identification as to
2 what this is and what it related to,
3 there's no tie or link to Johnson's Baby
4 Powder.

5 Q. Okay. But that wasn't any
6 of my questions, was it? My question was
7 McCrone is listing as not quantifiable,
8 no asbestos, in this report to Windsor,
9 yet they found asbestos, correct?

10 MR. BICKS: No foundation.

11 THE WITNESS: Well, they
12 reported they found a chrysotile
13 fiber and an anthophyllite
14 material.

15 BY MR. PLACITELLA:

16 Q. All right. So let's see if
17 I can abbreviate this deposition a little
18 bit. You tell me, true or false, the
19 answer to these questions. You have it
20 in front of you -- why don't we mark that
21 first.

22 (Document marked for
23 identification as Exhibit
24 Hopkins-4.)

1 BY MR. PLACITELLA:

2 Q. Hopkins-4. True or false:

3 Johnson & Johnson is aware
4 of test results indicating that asbestos
5 was found in Vermont talc mines used to
6 make Johnson's Baby Powder?

7 A. Asbestos was found in the
8 mines used to make Johnson's Baby Powder.
9 (Reading aloud).

10 I'm not aware that asbestos
11 has ever been found in the mines that we
12 used to make Johnson's Baby Powder, i.e.,
13 Hammondsville mine, Hamm mine, Argonaut
14 mine.

15 Q. So can you circle false
16 then?

17 A. No, I've got a pen.

18 Q. Johnson & Johnson -- next.

19 Johnson & Johnson is aware
20 of test results indicating that fibrous
21 tremolite was found in the Vermont talc
22 mines used to make Johnson's Baby Powder.
23 True or false?

24 MR. SILVER: Objection to

1 the form.

2 MR. BICKS: Objection to the
3 true/false, but go ahead.

4 THE WITNESS: It isn't
5 always possible to give a true or
6 false answer. You need to
7 actually give a bit more detail.
8 The Vermont talc mines cover --
9 Vermont is a darn big state.
10 There are dozens of talc mines in
11 Vermont. But the mines used to
12 make Johnson's Baby Powder do not
13 contain asbestos tremolite.

14 BY MR. PLACITELLA:

15 Q. Johnson & Johnson is aware
16 of test results -- I didn't ask that
17 question.

18 Johnson & Johnson is aware
19 of test results indicating that fibrous
20 tremolite was found in the Vermont talc
21 mines used to make Johnson's Baby Powder.
22 True or false?

23 MR. SILVER: Objection.

24 THE WITNESS: Again, this is

1 a question where there isn't an
2 easy answer. Fibrous tremolite
3 is, if it's asbestos, so the
4 answer would be false.

5 BY MR. PLACITELLA:

6 Q. So the answer is false?

7 A. That is my opinion, yes.

8 Q. Okay. Okay. False.

9 Next. Johnson & Johnson is
10 aware of test results indicating --

11 THE VIDEOGRAPHER: Put your
12 microphone on.

13 MR. PLACITELLA: I'm sorry.

14 BY MR. PLACITELLA:

15 Q. -- indicating that fibrous
16 amphiboles were found in the Vermont talc
17 mines used to make Johnson's Baby Powder.
18 True or false?

19 MR. SILVER: Objection to
20 form.

21 THE WITNESS: Again, my
22 answer is that that is false.

23 There is no fibrous amphiboles, if
24 they are equivalent to asbestos,

1 in the Johnson's Baby Powder.

2 BY MR. PLACITELLA:

3 Q. So you're not aware of any
4 test results. We'll make it false.

5 Okay. Next. Johnson &
6 Johnson is aware of test results
7 indicating that fibrous actinolite was
8 found in the Vermont talc mines used to
9 make Johnson's Baby Powder.

10 MR. SILVER: Objection to
11 the form.

12 BY MR. PLACITELLA:

13 Q. True or false?

14 MR. BICKS: Object to the
15 form.

16 THE WITNESS: Again, it's a
17 question that, how do you define
18 fibrous actinolite. If you're
19 saying, is it the asbestos
20 actinolite, form of actinolite,
21 then the answer is false.

22 BY MR. PLACITELLA:

23 Q. No, I'm using your
24 definition, sir. Fibrous actinolite. Is

1 Johnson & Johnson aware of test results
2 indicating that fibrous actinolite was
3 found in the Vermont talc mines that was
4 used to make Baby Powder?

5 A. I'm not aware, speaking for
6 Johnson & Johnson, of test results
7 indicating that that was the case. So
8 the answer again I'm going to give is
9 false.

10 Q. False. Okay.

11 Next. Johnson & Johnson is
12 aware of test results indicating that
13 fibrous talc was found in the Vermont
14 talc mines used to make Johnson's Baby
15 Powder. True or false?

16 MR. SILVER: Objection to
17 form.

18 THE WITNESS: You need to
19 define what is meant by "fibrous
20 talc."

21 Talc can occur -- pure talc
22 can occur in a fibrous form if
23 it's -- or a shard or a split from
24 talc. And it would appear as a

1 fiber. And so the answer is that
2 you can get fibrous talc in
3 Vermont talc mines.

4 BY MR. PLACITELLA:

5 Q. So the answer is true?

6 A. It could be true. But it
7 depends -- and this is the key thing with
8 this whole dialogue. It depends on how
9 you define these materials.

10 Q. I'm using your definition,
11 sir.

12 A. I --

13 Q. The definition that we
14 started out with.

15 A. I've never seen --

16 Q. The definition articulated
17 by Johnson & Johnson.

18 MR. BICKS: I don't think we
19 had fibrous talc.

20 THE WITNESS: I don't
21 believe I've ever seen the word
22 fibrous talc in a definition.

23 BY MR. PLACITELLA:

24 Q. We'll get there. So is this

1 false or true or you don't know?

2 A. I would say, yeah, because
3 we don't have a definition --

4 Q. Okay. Put a question mark.
5 You don't know.

6 A. I'll put an asterisk in the
7 middle.

8 Q. Well, okay. Well, I'm going
9 to put a question mark because you don't
10 know. Okay.

11 Next. Johnson & Johnson is
12 aware of test results indicating that
13 asbestos was found in the processed
14 Vermont talc used to make Johnson's Baby
15 Powder.

16 MR. SILVER: Objection to
17 form.

18 THE WITNESS: Again, I'm not
19 aware of any finding of asbestos
20 in Vermont talc.

21 BY MR. PLACITELLA:

22 Q. False?

23 A. That's my opinion, yes.

24 Q. I don't want your opinion.

1 I'm asking you --

2 A. Yes that's my statement on
3 behalf of Johnson & Johnson --

4 Q. Okay.

5 A. -- that that, I believe, is
6 false.

7 Q. All right. Johnson &
8 Johnson is aware of test results
9 indicating that fibrous talc was found in
10 the processed Vermont talc used to make
11 Johnson's Baby Powder. True or false?

12 MR. SILVER: Objection to
13 form.

14 THE WITNESS: Again, this is
15 very similar to the question --
16 the previous -- the previous one,
17 two before, where we talk about
18 what is fibrous talc.

19 It is talc that may occur by
20 being processed into a fiber. You
21 can get a fibrous talc. It's
22 still talc. It's not harmful.

23 So I'm not sure we've ever
24 measured fibrous talc. You're

1 talking about test results. I've
2 not seen test results for fibrous
3 talc.

4 BY MR. PLACITELLA:

5 Q. So false?

6 A. Well, I don't have the
7 answer to that because fibrous talc is
8 not a parameter that's measured as a
9 routine quality control process.

10 Q. And you've -- and Johnson &
11 Johnson has never seen any test results
12 indicating whether there was fibrous talc
13 in the mines that were used to make Baby
14 Powder. That's the question. You said
15 you don't know.

16 A. I'll say I don't know.

17 Q. Is fibrous talc harmful by
18 the way?

19 A. No.

20 Q. Okay. Johnson & Johnson --
21 next. Johnson & Johnson is aware of test
22 results indicating that fibrous tremolite
23 was found in the processed Vermont talc
24 used to make Johnson's Baby Powder. True

1 or false?

2 MR. SILVER: Objection to
3 the form.

4 MR. BICKS: Object to the
5 form.

6 THE WITNESS: Again, fibrous
7 tremolite, if it were asbestos
8 tremolite, then the answer would
9 be false.

10 BY MR. PLACITELLA:

11 Q. No, sir. I'm not asking you
12 to interpret or give an opinion.

13 The question is: Johnson &
14 Johnson is aware of test results
15 indicating that fibrous tremolite was
16 found in the processed Vermont talc used
17 to make Johnson's Baby Powder. True or
18 false?

19 MR. SILVER: Same objection.

20 BY MR. PLACITELLA:

21 Q. You are either aware or
22 you're not.

23 A. I'm going to give I don't
24 know because you've not defined fibrous

1 tremolite. It's a geologist's
2 description.

3 Q. Sir, I'm using your
4 definition.

5 A. That case --

6 Q. You say asbestos that is --
7 tremolite that is fibrous is asbestos.
8 Isn't that your definition?

9 A. The definition of asbestos
10 is more than just a fiber. It relates to
11 surface charge, flexibility, length.

12 Q. Sir --

13 A. There's a lot more to it
14 than --

15 Q. That's not in your
16 definition, with all due respect, that we
17 started with, is it?

18 A. Not with that definition
19 that you have back in the 1970s.

20 Q. And that was the Johnson &
21 Johnson definition, correct?

22 A. That was the definition --

23 Q. Okay.

24 A. -- which is written in the

1 specification --

2 Q. All right. So using the
3 definition that's written in your
4 specification of asbestos and fibrous
5 tremolite, Johnson & Johnson is aware of
6 test results indicating that fibrous
7 tremolite was found in the processed
8 Vermont talc used to make Johnson's Baby
9 Powder. True or false?

10 MR. BICKS: Object to the
11 form.

12 MR. SILVER: Objection.

13 THE WITNESS: And my answer
14 is false.

15 BY MR. PLACITELLA:

16 Q. Okay. False.

17 Next. Johnson & Johnson is
18 aware of test results indicating that
19 fibrous actinolite was found in the
20 processed Vermont talc used to make
21 Johnson's Baby Powder. True or false?

22 MR. SILVER: Objection to
23 form.

24 THE WITNESS: Again, it's

1 the same -- it's the same answer.
2 I've not seen test results for
3 Johnson's Baby Powder which
4 contained fibrous actinolite.

5 BY MR. PLACITELLA:

6 Q. That's not what this asks.

7 A. So -- no, I've said -- you
8 said are you aware of test results. And
9 I'm saying I'm not aware of test results.

10 Q. Okay. So false?

11 A. That's my --

12 Q. Okay.

13 A. -- opinion, yes.

14 Q. Okay. Next. Johnson &
15 Johnson is aware of test results
16 indicating that chrysotile was found in
17 the processed Vermont talc used to make
18 Johnson's Baby Powder. True or false?

19 MR. SILVER: Object to form.

20 THE WITNESS: Again, same
21 answer. It's false.

22 BY MR. PLACITELLA:

23 Q. False. Next. Johnson &
24 Johnson is aware of test results

1 reporting that asbestos was found in the
2 Vermont talc mines used to make Johnson's
3 Baby Powder. True or false?

4 MR. SILVER: Object to form.

5 THE WITNESS: I'm not aware
6 that asbestos has ever been found
7 in the mines that are used to
8 provide Johnson's Baby Powder.

9 BY MR. PLACITELLA:

10 Q. False?

11 A. So the answer would be
12 false.

13 Q. Next. Johnson & Johnson is
14 aware of test results reporting fibrous
15 tremolite was found in the Vermont talc
16 mines used to make Johnson's Baby Powder.

17 MR. SILVER: Object to form.

18 THE WITNESS: We had that
19 question already.

20 BY MR. PLACITELLA:

21 Q. It's a different question.

22 A. Okay. Again, the answer is
23 no, I've not seen results that there was
24 fibrous tremolite.

1 Q. Okay. Next. Johnson &
2 Johnson is aware of test results
3 reporting that fibrous amphiboles were
4 found in the Vermont talc mines used to
5 make Johnson's Baby Powder.

6 MR. SILVER: Object to form.

7 THE WITNESS: Again, the
8 same question. It is -- or a very
9 similar question. So I'm not
10 aware of results that report
11 fibrous amphiboles in the mines
12 used to make Johnson's Baby
13 Powder.

14 BY MR. PLACITELLA:

15 Q. Okay. False.

16 Next, Johnson & Johnson is
17 aware of test results reporting that
18 fibrous actinolite was found in the
19 Vermont mines used to make Johnson's Baby
20 Powder.

21 MR. SILVER: Object to form.

22 THE WITNESS: Again, I've
23 not seen results that report that.

24 BY MR. PLACITELLA:

1 Q. Okay. False. Johnson &
2 Johnson is aware of test results
3 reporting that fibrous talc was found in
4 the Vermont talc mines used to make
5 Johnson's Baby Powder?

6 MR. SILVER: Object to form.

7 THE WITNESS: Again, same
8 story. I've not seen reports on
9 fibrous talc in the talc mines.

10 BY MR. PLACITELLA:

11 Q. Okay. We're almost done.
12 Johnson & Johnson is aware
13 of test results reporting that asbestos
14 was found in the processed Vermont talc
15 used to make Johnson's Baby Powder?

16 MR. SILVER: Object to form.

17 THE WITNESS: Again, I'm
18 saying false. That's a false
19 statement.

20 BY MR. PLACITELLA:

21 Q. Next. Johnson & Johnson is
22 aware of test results reporting that
23 fibrous talc was found in the processed
24 Vermont talc used to make Johnson's Baby

1 Powder?

2 MR. SILVER: Object to form.

3 THE WITNESS: Again, I've

4 not seen test results reporting

5 fibrous talc in Baby Powder.

6 BY MR. PLACITELLA:

7 Q. Next. Johnson & Johnson is
8 aware of test results reporting that
9 fibrous tremolite was found in the
10 processed Vermont talc used to make
11 Johnson's Baby Powder?

12 MR. SILVER: Object to form.

13 THE WITNESS: Again, I am

14 not aware of any test results that

15 report fibrous tremolite --

16 BY MR. PLACITELLA:

17 Q. False?

18 A. -- in the ore, so in talc.

19 So I'm saying false.

20 Q. Next. Johnson & Johnson is
21 aware of test results reporting that
22 fibrous actinolite was found in the
23 processed Vermont talc used to make
24 Johnson's Baby Powder.

1 MR. SILVER: Object to form.

2 MR. BICKS: Object to the

3 form.

4 THE WITNESS: Again, I'm not
5 aware of test results that report
6 fibrous actinolite in the talc --

7 BY MR. PLACITELLA:

8 Q. So false?

9 A. -- relating to Baby Powder.

10 Yes.

11 Q. Okay. Last one. Johnson &
12 Johnson is aware of test results
13 reporting that chrysotile was found in
14 processed Vermont talc used to make
15 Johnson's Baby Powder?

16 MR. SILVER: Object to form.

17 THE WITNESS: Again, I've
18 not seen results that indicate
19 that chrysotile is in the talc.

20 MR. PLACITELLA: Can you
21 give me Exhibit 1?

22 MR. LOCKE: Before we move
23 on, what's happening with these
24 slides? Are they --

1 MR. PLACITELLA: It's been
2 marked, and he's marked them. And
3 it's marked as an exhibit.

4 MR. LOCKE: When you're
5 saying he's marked them.

6 MR. PLACITELLA: It's been
7 marked, and he's been circling
8 them. Yes.

9 (Document marked for
10 identification as Exhibit
11 J&J-1.)

12 BY MR. PLACITELLA:

13 Q. Exhibit J&J-1 is a progress
14 report from the Battelle Field of
15 Research dated May 9, 1958. You've seen
16 this document before, correct?

17 A. Correct.

18 MR. BICKS: I think you
19 pronounce it Battelle.

20 THE WITNESS: Yes, I have
21 seen it some time ago, yes.

22 MR. PLACITELLA: Okay.
23 Actually my aunt who is off the
24 boat, she says Battelle. That's

1 how you know. So I'll use
2 whatever you want.

3 MR. SILVER: This is a
4 different Exhibit 1 than the other
5 Exhibit 1?

6 MR. PLACITELLA: That was
7 Hopkins-1.

8 BY MR. PLACITELLA:

9 Q. If you go to Page 3 --

10 MR. SILVER: What was the
11 first Bates again?

12 MR. PLACITELLA: Oh, you
13 need a Bates number.

14 JNJAZ55_000000906. Okay. If you
15 go to Bates number 912. I gave
16 the date.

17 BY MR. PLACITELLA:

18 Q. This states that the Italian
19 Talc Number 1 contains from less than 1
20 percent to about 3 percent of
21 contaminants.

22 Do you see that?

23 A. That's what's written, yes.

24 Q. And it indicates that the

1 amphibole component that they found was
2 tremolite, correct?

3 A. Yes. Yes, it does say, yes.
4 A variety of tremolite, yes.

5 Q. And then if you go to the
6 next page, there's a bunch of charts that
7 talk about the percent of tremolite that
8 was found.

9 Do you see that?

10 A. What table is this? Which
11 table?

12 Q. Table 1. And then Table 2.
13 Do you see that? Table 1 is titled --

14 A. Yeah, I'm just reading -- it
15 doesn't say what the contaminants were.
16 It describes them as 1 percent or -- yes,
17 okay.

18 Q. All right. And you see that
19 this was testing that was done actually
20 not in Italy, but in the plant in
21 Cranford, New Jersey.

22 Do you see that?

23 A. Yes.

24 Q. So I guess Battelle is okay.

1 And you see on Table 2 where
2 it talks about the mineral contaminants?

3 A. Yes.

4 Q. And do you see where it says
5 tremolite?

6 A. Yes, I do.

7 Q. And it talks about basically
8 from zero to trace amounts, correct?

9 A. It does.

10 Q. What's trace-1 mean, if you
11 know?

12 A. I don't know.

13 Q. Okay.

14 A. The limit of detection, I
15 would guess.

16 Q. If you go to Page 17 of the
17 report, it clearly states that the talc
18 contains tremolite. Can we agree?

19 MR. SILVER: Objection to
20 form.

21 THE WITNESS: Yes. Trace.
22 Zero to trace. Yes.

23 BY MR. PLACITELLA:

24 Q. Okay. And then a little bit

1 further down on Page 28 -- I'm sorry, go
2 to Page 31. I'll cut this short.

3 It talks about keeping the
4 amphiboles less than 1 percent, correct?

5 MR. BICKS: Where? Where
6 are we?

7 THE WITNESS: It says, "The
8 following are the recommendation
9 requirements for beneficiation
10 products to be equivalent of
11 Number 1 talc."

12 BY MR. PLACITELLA:

13 Q. All right. So I want to try
14 to keep these as we go through them. So
15 I'm going to ask Lea to actually make a
16 chart.

17 MR. PLACITELLA: Can we take
18 J&J-1. Can you put that up?

19 BY MR. PLACITELLA:

20 Q. I made some columns. The
21 date, the exhibit number, the entity, the
22 author, the recipients, the purpose of it
23 stated, the test method, the mines, what
24 was tested, any special preparations,

1 what the test showed. And we'll leave
2 the last one for another day.

3 MR. PLACITELLA: Can you
4 fill that in, Lea?

5 BY MR. PLACITELLA:

6 Q. Is that a fair assessment of
7 what the document states, what's on the
8 screen now?

9 A. I believe so.

10 Q. Okay.

11 MR. PLACITELLA: Give me
12 J&J-2.

13 (Document marked for
14 identification as Exhibit
15 J&J-2.)

16 BY MR. PLACITELLA:

17 Q. J&J-2 is another progress
18 report from Battelle Memorial institute.
19 This is this is dated May 23, 1958. The
20 Bates number, JNJNL61, a bunch of zeros,
21 134.

22 Do you see that?

23 A. Yes.

24 Q. Okay. It's by Brown Smith &

1 MacDonald.

2 Do you see that?

3 A. Yes.

4 Q. And in the introduction it
5 says, "Johnson & Johnson is obtaining raw
6 material for Baby Powder talcum from
7 Italian deposits. The talc is regarded
8 as very good quality." Correct?

9 A. Yes.

10 Q. Okay. And you understand
11 that this -- you've seen this report.
12 This report is a test for what's in the
13 talc that's going into the baby powder,
14 correct?

15 A. Well, that's one aspect of
16 it. The point of the report is to
17 understand and develop a process for
18 beneficiation, how to -- washing of the
19 talc, cleaning it up, and getting the
20 particles you want, the large platy ones
21 to rise to the top of the vessel so that
22 you can use those to make the baby
23 powder. So it's a manufacturing process.

24 Q. Sure. Fair enough.

1 If you go to Page 4 of the
2 report under samples tested. It talks
3 about Italian Number 1 and Italian Number
4 2 talc tested?

5 A. Yes. They are -- Battelle
6 are looking at those two talcs in their
7 investigation for beneficiation.

8 Q. And they find that
9 approximately 6 percent of the talc in
10 the Number 2 talc is fibrous and 8 to
11 10 percent of the talc in the Number 1
12 talc is fibrous, correct?

13 A. That's what's reported in
14 this report.

15 Q. Okay. And they here report
16 tremolite, correct?

17 A. The word "trace" appears,
18 yes.

19 Q. Well, they have trace and
20 then they have a Number 1?

21 A. A one, yes.

22 Q. What's one mean?

23 A. I don't know.

24 Q. Okay. Now, on Page 5, they

1 state, "Non-platy talc contained in the
2 Italian samples is mostly fibrous or
3 acicular in form. It is difficult to
4 distinguish acicular talc from remnants
5 of platelets and tremolite in sizes
6 similar" -- "smaller than 10 microns,"
7 correct? That's what it says?

8 A. Yes, you read what was
9 written --

10 Q. And it then says --

11 A. -- yes, in talc, yes.

12 Q. -- "Table 2 includes, for
13 comparison, the composition of the
14 Italian Number 1 grade, which is the raw
15 material" -- "raw material currently used
16 in Johnson & Johnson Baby Powder. The
17 minute logical difference between Number
18 1 and 2 grades is almost insignificant,
19 correct?

20 A. You read what was written.
21 Yes.

22 Q. Okay. Go down to Page 14 to
23 Table 15. Table 15 is where they compare
24 the testing for the Italian Number 1 and

1 Number 2 talc, correct?

2 A. Yes.

3 Q. And they find that in the
4 raw talc there is fibrous talc, correct?

5 A. That's what they reported.
6 Yes.

7 Q. And after they do the
8 beneffection (sic) process where they
9 float it to try to separate out the
10 contaminants, they still find fibrous
11 talc, correct?

12 MR. BICKS: It's
13 beneficiation.

14 THE WITNESS: Beneficiation
15 is the process of trying to
16 achieve the larger particles that
17 you want. You try to get more of
18 those.

19 BY MR. PLACITELLA:

20 Q. And after that process, on
21 the finished product they still find
22 fibrous talc, correct?

23 A. Yes.

24 Q. And in all the samples they

1 find tremolite, some a lot lower than
2 others, correct?

3 A. They report tremolite, yes.

4 Q. So can we go to -- back to
5 our chart. I had Lea put up while you
6 were testifying the date, the exhibit.
7 They looked at the processed talc and
8 they found tremolite, and 6 to 10 percent
9 fibrous talc.

10 MR. PLACITELLA: You have to
11 put a space. You can't make that
12 tremolite 6 to 10 percent. You've
13 got to take that out.
14 Different -- different line.
15 Semicolon. Let's make sure we got
16 it right. Okay.

17 BY MR. PLACITELLA:

18 Q. Is that fair?

19 MR. LOCKE: Can we put that
20 on a different line?

21 MR. PLACITELLA: I'm sorry?

22 MR. LOCKE: Can we put it on
23 a different line, 6 to 10 percent
24 fibrous talc.

1 BY MR. PLACITELLA:

2 Q. How is that? Is that fair?

3 A. I think that's representing
4 what was in that report in 1958.

5 Q. Okay, great.

6 MR. PLACITELLA: So give me
7 nine.

8 (Document marked for
9 identification as Exhibit
10 J&J-9.)

11 BY MR. PLACITELLA:

12 Q. I'll show you what's been
13 marked Exhibit 9. I think you've seen
14 this before, in reading your testimony.

15 Exhibit 9 is a report from
16 the Colorado School of Mines, dated
17 December 4, 1970, for Johnson & Johnson,
18 concerning the geology and ore reserves
19 of the Hammondsville mine, correct?

20 A. It is, yes.

21 Q. And it states -- and it
22 states, "The attached report completes
23 our work on the nature and magnitude of
24 our ore body in Vermont from which we

1 manufacture baby powder talc," correct?

2 A. Yes.

3 Q. And you've seen this before?

4 A. I believe so, yes.

5 Q. Okay. And in the
6 introduction, it talks about how you
7 engaged the Colorado School of Mines to
8 conduct the study, correct?

9 A. Yes.

10 Q. And it was authorized and
11 accepted by Mr. Talc himself, William
12 Ashton, correct?

13 A. It says, "The study was
14 authorized by letter from William Ashton,
15 June 1970.

16 Q. Okay. And what it states on
17 Page 13 is that they looked at 38 core
18 samples, correct?

19 A. Page?

20 Q. 13.

21 A. 13.

22 Q. On the bottom. I blew it
23 up.

24 A. Oh, yes.

1 Q. Hopefully I'll highlight it
2 for you. Make it easier.

3 A. Okay.

4 Q. And on Page 19, it says that
5 the method that was used was an x-ray
6 examination and petrographic, correct?

7 A. Yes.

8 Q. And if you go to Table 1
9 which would be on Page 20, they found
10 tremolite, correct?

11 MR. SILVER: Mr. Placitella,
12 can I ask you to -- for my
13 colleague, can you blow up the
14 Bates number, so he can --

15 MR. PLACITELLA: Sure.

16 BY MR. PLACITELLA:

17 Q. They find tremolite on Table
18 1, correct?

19 A. They reported a peak height
20 with tremolite. Yes.

21 Q. Okay. And on the next page,
22 they continued to report tremolite,
23 correct?

24 A. Yes they report that. The

1 interval 223A as part of their core
2 drilling.

3 Q. Okay. And they also
4 report -- well, what they do here is they
5 basically go down different levels of the
6 mine, correct, and they take samples and
7 test them at different levels, correct?

8 A. Yeah. So you know where to
9 go, where the talc is and where it isn't.

10 Q. Right. And they use a
11 diamond drill like you said. And they
12 use XRD, correct?

13 A. They --

14 Q. And they found --

15 A. They did. Yes.

16 Q. -- tremolite and actinolite,
17 right?

18 A. They reported that in one of
19 the holes, yes.

20 Q. So when they say 2.5, does
21 that mean 2.5 percent?

22 A. My understanding is no.
23 It's -- the x-ray diffraction peak
24 heights in centimeters, so I don't

1 believe that translates to percentages.

2 Q. Okay. But if you look a
3 little further down, they're talking
4 about fibrous talc in the mine that was
5 used to make Baby Powder, and it says 10
6 percent correct?

7 MR. BICKS: Objection to the
8 form.

9 THE WITNESS: Where are you
10 reading 10 percent?

11 BY MR. PLACITELLA:

12 Q. Table 2. Look at Bates
13 Number 184.

14 A. Okay, you've gone 14 pages
15 ahead.

16 Q. Yeah I'm trying to move this
17 through so we can get done.

18 A. Okay. This is a different
19 table.

20 Q. Right.

21 A. Yes, and -- yes, they've
22 given percentages here, which is
23 different from the peak heights.

24 Q. And they found 10 percent

1 fibrous talc in the mine that was used to
2 make Johnson's Baby Powder, true?

3 MR. SILVER: Object to form.

4 MR. BICKS: Object to form.

5 THE WITNESS: Well, they
6 found -- when they were doing the
7 diamond drilling, there are
8 certain areas where they found
9 fibrous talc, yes.

10 BY MR. PLACITELLA:

11 Q. Okay.

12 A. But that does not
13 necessarily mean the areas where the
14 product was mined to make Johnson's Baby
15 Powder.

16 Q. Okay. Go to Table 3, next
17 page, ends with 185. Percentage of
18 fibrous talc, depending on what level,
19 ranges from five to 20 percent, correct?

20 A. Yeah. Again, this is
21 diamond drill hole number 6-67H, and they
22 reported that they found fibrous talc
23 10 -- you know, various holes, 10,
24 20 percent, 10, yes, 5 percent. Yeah on

1 those particular drill holes.

2 Q. Okay. Let's just do one
3 more and we'll go to the next document.
4 Look at Table 11.

5 A. What page, Bates number?

6 Q. 197.

7 A. Okay.

8 Q. They're still finding 5 to
9 10 percent fibrous talc, correct?

10 A. Yes. In diamond drill hole
11 40-67-H --

12 Q. Okay.

13 A. -- they have found that over
14 their best study -- the study.

15 Q. And they found tremolite
16 repeatedly right? I mean, I could --
17 Table 13 they found tremolite.

18 MR. BICKS: Objection to
19 form.

20 BY MR. PLACITELLA:

21 Q. Table 16 they found
22 tremolite. Table 14 they found
23 tremolite?

24 A. The tables report what they

1 find.

2 Q. Right. And if you go to
3 Bates Number 260. They actually start to
4 describe each of the specimens that
5 they -- well, let me ask you the question
6 this way to cut it short. Do you agree
7 with me that they found both tremolite
8 and fibrous talc throughout the
9 Hammondsville mine when they did this
10 testing?

11 MR. BICKS: Objection to the
12 form.

13 THE WITNESS: Now that
14 you're phrasing that in a way that
15 is prejudicial, the whole point of
16 doing testing and diamond
17 drilling, you go over many acres,
18 you drill down to find where you
19 can mine and where you don't mine.

20 So they obviously found
21 areas where those materials they
22 didn't want. And there are areas,
23 the vast number of core drills
24 which didn't report those features

1 and those findings, so --

2 BY MR. PLACITELLA:

3 Q. So --

4 A. So the whole point is that
5 you need to know where you're going. And
6 the whole point is that you're doing a
7 mine mapping to create that picture of
8 where the good stuff is and where it
9 isn't.

10 Q. And this is all in a diamond
11 mined section, right?

12 A. They do lots of drills,
13 many, many drills over many acres to --
14 to get an understanding of where you can
15 mine and where you don't mine.

16 Q. All right. So I'm trying to
17 understand. So the camera is on me,
18 right?

19 So you drill straight down
20 and you find tremolite here, fibrous talc
21 here, nothing here, tremolite here,
22 fibrous talc here. And you say they kind
23 of maneuver around that and they only
24 pull out that little piece and that's

1 what they take and put in the Baby
2 Powder, right?

3 MR. LOCKE: Objection.

4 MR. BICKS: Objection to the
5 form.

6 THE WITNESS: Well, that's a
7 bit --

8 BY MR. PLACITELLA:

9 Q. That's what I'm trying to
10 understand.

11 A. No, that's a bit theatrical.

12 Q. Well, I'm theatrical because
13 it is important.

14 A. It is important. But the
15 whole point I'm trying to make at this
16 point is that when you do diamond core
17 samples over many acres, you get a
18 picture of what the mining area can do
19 and what it cannot do.

20 So it allows you to operate
21 in those areas that will give you the
22 product you want. It allows you to avoid
23 those areas that you don't want. That's
24 the whole point of diamond core drilling.

1 You're going to get results which you
2 say, wow, we're not going to drill there,
3 thank you.

4 MR. BICKS: Chris, we've
5 been going about an hour and a
6 half.

7 MR. PLACITELLA: One more
8 question, and then we'll stop.

9 MR. BICKS: Yeah.

10 MR. PLACITELLA: Or two,
11 because we're going to have to
12 switch.

13 BY MR. PLACITELLA:

14 Q. But the purpose of this was
15 to look at the geology of the ore
16 reserves for the Hammondsville mine that
17 was going in the Baby Powder, right?

18 A. Yes. You're looking at the
19 big picture.

20 MR. PLACITELLA: All right.
21 Can you -- Lea, did you type it
22 in? All right. Can you switch
23 over?

24 BY MR. PLACITELLA:

1 Q. So the third entry,
2 12/4/1970, XRD and petrographic. The
3 author, here we have Ashton and Miller.
4 Got it. Hammondsville mine. 38 core
5 samples. Tremolite actinolite fibrous
6 talc, correct?

7 MR. LOCKE: Objection.

8 MR. BICKS: Objection.

9 BY MR. PLACITELLA:

10 Q. Is that fair?

11 A. That's not accurate.

12 Q. Okay. Tell me what to take
13 out.

14 A. You described it as "the
15 mine" as being the whole area where the
16 company has been mining for Baby Powder.

17 Q. No, I just said where they
18 took it, the Hammondsville mine.

19 A. Yes, and what I'm saying to
20 you is that you put the word
21 "Hammondsville," which covers a large
22 acreage. And that would include areas
23 that are not mined.

24 Q. How do you want me to change

1 it? How do you want to change it?

2 A. I think it's not very
3 relevant anyway. But I think what you
4 need to do to give it a bit more clarity
5 is to say the whole picture, and you
6 can't just put that in one word. The
7 whole picture here is that you've got
8 large acreage, some of which you are
9 going to use for mining baby powder, and
10 others that you will say we'll avoid it.

11 And what -- what we've done
12 here with this report is to identify
13 those areas that you can avoid, having
14 done your diamond drilling, to actually
15 say, well, we can find the pure talc for
16 Baby Powder.

17 Q. Well, that's your
18 interpretation. Do you have any
19 contemporaneous documents to back up what
20 you say?

21 MR. LOCKE: Objection.

22 MR. BICKS: Argumentative.

23 BY MR. PLACITELLA:

24 Q. I mean, do you?

1 A. The whole point of diamond
2 core drilling over many acres is to
3 understand the total geology of the
4 picture.

5 Q. Okay. Let's just look at
6 this entry.

7 All I'm saying is they
8 looked in the Hammondsville mine and they
9 found tremolite, actinolite and fibrous
10 talc.

11 A. No, they looked in the
12 Hammondsville area, the mine -- the mine
13 wasn't actually in that area at that
14 time. The mining area is bigger than
15 just the Hammondsville mine.

16 Q. Wait, wait, wait a second.

17 A. In 1970 it was operating --

18 Q. It states, "The report deals
19 entirely with the geology and ore
20 reserves of the Hammondsville mine."

21 It doesn't talk about area.

22 A. Yeah, but the Hammondsville
23 mine is -- covers an area that you're
24 going to use and some that you're not

1 going to use.

2 Q. It says, "The Hammondsville
3 mine." That's the only thing that I put
4 up on the list. Hammondsville. Tell me
5 how you want me to change the words.

6 A. I wouldn't put that up in
7 the first place.

8 The point that I'm trying to
9 make is that it's identifying areas in
10 the mine that you can use and you could
11 avoid.

12 Q. Well, you already said that.

13 MR. PLACITELLA: All right.
14 Let's take a break.

15 THE VIDEOGRAPHER: Stand by.
16 Please remove your microphones,
17 please. The time is 3:06 p.m.
18 going off the record.

19 (Short break.)

20 THE VIDEOGRAPHER: We are
21 book on the record. The time is
22 3:21 p.m.

23 (Document marked for
24 identification as Exhibit

1 J&J-256.)

2 BY MR. PLACITELLA:

3 Q. I'm going to give you what's
4 been marked as 256. I don't know why
5 these don't have Bates numbers.

6 This is -- I'm going to
7 refer you to the third page of the
8 document, which is a June 30th, 1971
9 letter from Pattengill to Ashton.

10 Do you see that?

11 A. Yes, yes.

12 Q. Okay. And in this letter,
13 Pattengill, he's with the Colorado
14 School, correct?

15 A. Yes.

16 Q. He -- he tells Ashton, that
17 based upon x-ray defraction and
18 microscopical analysis of Vermont
19 finished product -- product plant run
20 sample, that they found trace amounts of
21 tremolite and actinolite, correct?

22 A. Yes. It said sample 344-L,
23 and six monthly, only trace amounts of
24 tremolite and actinolite. It's actually

1 a hyphen, not "and."

2 Q. Okay. And it says, "No
3 other forms of non-talc minerals
4 approaching asbestos types were
5 identified," correct?

6 A. That is what is written.

7 Q. Okay. If you go to --
8 scroll down a little bit to the May 19,
9 1971. Here, I can do it for you. Let me
10 do it for you.

11 A. We don't have a --

12 Q. Yeah, I know. This is how
13 it was produced. I have no idea why
14 there's no Bates number.

15 This is a letter from
16 Pattengill to Ashton, May 19, 1971. And
17 he says, "The following are the results
18 of x-ray diffraction analysis on six of
19 the monthly plant" -- "plant run talc
20 samples."

21 Do you see that?

22 A. Yes.

23 Q. And they find
24 tremolite-actinolite in five of the six

1 samples, correct?

2 A. They reported, yes, they
3 reported that on five samples.

4 Q. Okay.

5 MR. PLACITELLA: So can you
6 put that up, Exhibit 256.

7 Are you ready or should we
8 do one and come back.

9 Okay. We'll come back to
10 that.

11 Give me Exhibit 19.

12 (Document marked for
13 identification as Exhibit
14 J&J-19.)

15 BY MR. PLACITELLA:

16 Q. Exhibit 19 is a memo on
17 Johnson & Johnson's letterhead from a
18 Mr. Nashed. Who's he?

19 A. He was a senior research
20 scientist --

21 Q. Mr. Foster. Who is he?

22 A. Mr. Foster was in the -- in
23 corporate headquarters in New Brunswick.

24 Q. All right. And --

1 A. He was not a scientist.

2 Q. Okay. Mr. Nashed knows what
3 he's talking about, correct?

4 A. Mr. Nashed was a scientist,
5 yes.

6 Q. Right. And he states, "The
7 talc used in Johnson's Baby Powder is
8 obtained from a selected mine in Vermont
9 where the ore consists mainly of platy
10 talc with only trace amounts of fibrous
11 minerals (tremolite/actinolite)."
12 Correct?

13 A. You read what was written.

14 Q. Okay. He further says that
15 three separate laboratories found fibrous
16 minerals in the Vermont mine, correct?

17 A. Which?

18 MR. BICKS: I'm sorry.

19 THE WITNESS: I can't see
20 that paragraph.

21 BY MR. PLACITELLA:

22 Q. See where it says, "The ore
23 undergoes a careful purifying process"?

24 A. Yes.

1 Q. Okay. Then he says, "The
2 resulting talc has been shown by three
3 independent consulting laboratories to
4 contain negligible traces of fibrous
5 minerals and no chrysotile fibers,"
6 correct?

7 A. Yes. Negligible traces of
8 fibrous minerals, yeah.

9 Q. So he reports here that
10 three separate independent laboratories
11 all found fibrous minerals in the talc
12 used in Johnson's Baby Powder, correct?

13 A. He describes those fibrous
14 minerals. Yes.

15 MR. PLACITELLA: Okay. Can
16 we go back and put 256 in and 19.

17 (Document marked for
18 identification as Exhibit
19 J&J-256.)

20 BY MR. PLACITELLA:

21 Q. So 256 outlines the testing
22 entity was Colorado, the test method was
23 XRD and PLM. It was six monthly plant
24 run samples. And reported was five of

1 six show tremolite/actinolite. And then
2 I put in quotes from the document, "No
3 other forms of non-talc minerals
4 approaching asbestos types were
5 identified." Fair?

6 A. That is what is written in
7 the cover letters.

8 Q. Okay. And then on 19, also
9 from the Colorado -- well, we have
10 Colorado school of mines. Is that the
11 testing entity? It doesn't really say.

12 A. It does. It actually says
13 the resulting talc has been shown by
14 three independent laboratories, asterisk,
15 and then the asterisk is Colorado School
16 of Mines -- turn the page -- McCrone, and
17 Dartmouth College.

18 Q. Okay. So Colorado school of
19 mines. Then we have to put McCrone and
20 Dartmouth. And I put trace amounts of
21 fibrous minerals, tremolite -- it should
22 be not slash, but dash actinolite.

23 MR. PLACITELLA: Lea.

24 BY MR. PLACITELLA:

1 Q. Correct. No, it's slash.
2 You're right.

3 A. Yeah, it did say slash. But
4 that doesn't matter. I think the point
5 is that we talk about three independent
6 laboratories. The Dartmouth College
7 report's finding of no tremolite. And
8 I'm not sure what McCrone reports. It
9 doesn't say.

10 Q. We --

11 A. But what they actually say
12 in the text, and that's important, is
13 that they contain negligible traces of
14 fibrous minerals. It doesn't actually
15 define them as actinolite-tremolites.

16 Q. Well, on the first one it
17 does, the first paragraph?

18 A. The first paragraph it does,
19 yes.

20 Q. Okay.

21 A. But then when it goes on to
22 talk about the three independent
23 laboratories, it just describes as
24 negligible traces of fibrous minerals.

1 Q. Okay. So how do you want me
2 to put it in there?

3 A. I think that's separate.

4 MR. PLACITELLA: Okay. Put
5 a semi colon and put that
6 separate, Lea.

7 BY MR. PLACITELLA:

8 Q. Give me 100.

9 (Document marked for
10 identification as Exhibit
11 J&J-100.)

12 BY MR. PLACITELLA:

13 Q. 100 is another memo written
14 from the Colorado School of Mines to
15 Mr. Ashton, correct?

16 A. Yes.

17 Q. Okay. It talks about
18 testing talc ore, five talc samples.

19 A. Yes.

20 Q. Okay. And they use an x-ray
21 diffraction and a separation method,
22 correct?

23 A. Yes, they were evaluating a
24 heavy liquid concentration method.

1 Q. Right. And that was using a
2 centrifuge, correct?

3 A. That is my understanding,
4 yes.

5 Q. Okay. That's -- and the
6 purpose of that is really not that
7 different in principle than the
8 benefaction (sic) process, right? What
9 the benefaction process does is it takes
10 out -- it separates out contaminants, and
11 this just further separates out
12 contaminants, correct?

13 A. No. I think that's an
14 oversimplification. Beneficiation, the
15 point of that is to not be concerned
16 about the contaminants, is to achieve a
17 talc that has large clean plates that are
18 large and smooth --

19 Q. Okay.

20 A. -- and remove the bits, the
21 dust, the sand that you don't want.

22 Q. Well, what the Colorado
23 School of Mines did here is, they used a
24 separation technique using a centrifuge

1 right?

2 A. They did, yes, yes.

3 Q. And what they found was
4 tremolite, actinolite, they say slight
5 traces, correct?

6 A. They use that word, yes.

7 Q. Okay. They find
8 anthophyllite, correct, on the second
9 page?

10 A. They report that. Well,
11 with a question mark. They weren't sure.

12 Q. Okay. And then on the
13 bottom where they say, "Relative to
14 possible asbestos minerals, the above
15 table shows that Samples 31-7-S and
16 30-B-71-S contain slight traces of
17 tremolite/actinolite minerals," correct?

18 A. That's what they wrote in
19 1973.

20 Q. In the context of asbestos
21 type minerals, correct?

22 A. That's what they wrote, yes,
23 in 1973.

24 Q. And they also say that

1 sample 32-71-S is suspected to contain
2 very minor amounts of serpentine which
3 may be chrysotile, correct?

4 A. That's what they wrote. But
5 it was -- I'm trying to find that.
6 Sample, slight trace -- yeah. It's
7 suspected. And they go on to say more
8 studies need to be made. So they don't
9 confirm it. They say, if we want to
10 confirm it, you have to do more studies.

11 MR. PLACITELLA: All right.
12 So can we put that one in, Lea.
13 Can you put it up. Make sure
14 we're on the same page. I'll do
15 one more from Colorado after this.

16 BY MR. PLACITELLA:

17 Q. Here we have Colorado School
18 of Mines, processed talc. They used a
19 centrifuge. Tremolite-actinolite, slight
20 trace of anthophyllite and "asbestos-type
21 materials."

22 A. And I think in the interest
23 of balance, they have used a question
24 mark after anthophyllite because they

1 weren't sure.

2 MR. PLACITELLA: Okay.

3 We'll put a question mark. We're
4 good. It's there already.

5 THE WITNESS: On the
6 serpentine in the text, they
7 actually say -- they don't really
8 know. It may be. They've used
9 the word "may," and it's
10 recommended to conduct further
11 studies --

12 BY MR. PLACITELLA:

13 Q. Okay.

14 A. -- on that particular sample
15 to confirm the presence.

16 So, again, it has to be a
17 question mark.

18 Q. So should I leave out
19 chrysotile or put a chrysotile with a
20 question mark?

21 A. I don't mind.

22 MR. PLACITELLA: Put
23 chrysotile with a question mark.

24 THE WITNESS: They've

1 described it as a serpentine.
2 They don't actually use the
3 word -- oh, they say it may be
4 chrysotile. It is a serpentine
5 but it may be chrysotile. But
6 it's questionable.

7 BY MR. PLACITELLA:

8 Q. Okay. Last one for
9 Colorado, and we'll go to a different
10 place.

11 MR. PLACITELLA: 263.

12 (Document marked for
13 identification as Exhibit
14 J&J-263.)

15 BY MR. PLACITELLA:

16 Q. 263 is another Colorado
17 School of Mines Research Institute
18 document. And the second page talks
19 about a procedure to examine talc for the
20 presence of chrysotile and
21 tremolite-actinolite fibers.

22 Do you see that?

23 A. Yes.

24 Q. And the date of this is

1 December 27th, 1973.

2 A. Yes.

3 Q. Do you see that?

4 A. It is, yes.

5 Q. Okay. And here they're
6 talking about -- that the proposal is to
7 use this pre-concentration method because
8 without it, according to your advisors,
9 it's like looking for a needle in a
10 haystack, right?

11 A. Well, as with any research
12 establishments, they often come with a
13 proposal and say we'd like to do this.
14 Here's a proposal.

15 Q. Okay. And they said on Page
16 1 in the introduction, the reason that
17 they were going to do that is because
18 without it, it would be like looking for
19 a needle in a haystack, right?

20 MR. BICKS: Objection to
21 form.

22 THE WITNESS: That's what
23 they wrote back in 1973.

24 BY MR. PLACITELLA:

1 Q. Okay. And the objective was
2 to develop a procedure to screen talc for
3 the presence of chrysotile and/or
4 tremolite-actinolite asbestos minerals,
5 correct?

6 A. Yeah. They are trying to
7 evolve a method and procedure which does
8 a pre-concentration.

9 Q. Right. And method was again
10 on Bates Number 204 using a centrifuge,
11 correct?

12 A. Yes.

13 Q. All right. And what they
14 report on 211, is they sent a letter to
15 Mr. Ashton on December 21, 1973, where
16 they identify chrysotile in the Vermont
17 talc, correct?

18 A. Now, I need to read the
19 report first.

20 Q. Sure.

21 A. I don't see where they
22 identified it in the -- in the Vermont
23 talc. They are doing the study where
24 they claim to find it. But the normal

1 process is that you deliberately add 1
2 percent or 2 percent or whatever to see
3 if you can find it.

4 Q. Well, look at -- look at
5 Bates Number 211. I highlighted it for
6 you? Here it says, "A letter report
7 dated December 21, 1973, from WP Reid to
8 WH Ashton. On the examination of Italian
9 and Vermont talc, identified chrysotile
10 at a level of less than 10 parts per
11 million in the Vermont sample." Correct?

12 A. Okay. Where are you
13 reading, which line or -- the top half of
14 the page?

15 Q. I blew it up, right in the
16 middle.

17 A. I see it. Let me read it
18 now.

19 Q. Sure.

20 A. That's what's written there.
21 Whether that was ever a validated or
22 proven, it certainly -- they claim it was
23 less than 10 parts per million.

24 Q. But that's what was

1 reported?

2 A. If they found it at all, it
3 would be less than 10 parts per million.

4 Q. I'm not saying if they found
5 it at all. That's what's written as
6 reported, correct?

7 A. I need to see that letter
8 again to -- do we have that letter. We
9 just looked at that letter?

10 Q. Well, that's -- that's kind
11 of the problem. I can't find the letter.
12 I'm looking at the report. I mean,
13 that's what's reported in the report?

14 A. Okay. Let's take a step
15 back. When you're developing a method
16 it's not unusual to deliberately spike
17 your product, in this case talc, with --

18 Q. Excuse me, sir, I don't mean
19 to cut you off. But there's no question
20 about that. All I'm asking you is
21 reported here states that they found
22 chrysotile in Vermont talc at less than
23 ten parts per million. That's what's
24 stated. It doesn't say anything about

1 spiking, correct?

2 A. It does not, no.

3 Q. Okay.

4 A. It says, "Identified at a
5 level of less than 10 parts per million."

6 Q. Okay. Thank you. Now, when
7 you testified recently in St. Louis, do
8 you remember that experience?

9 A. I remember testifying in St.
10 Louis, yes.

11 Q. Mr. -- do you remember
12 Mr. Lanier. He was asking you questions?

13 A. I remember him, yes.

14 Q. He -- you testified in
15 St. Louis, that a Dutch consumer group
16 found asbestos in baby powder. Do you
17 recall that?

18 A. I remember there was a
19 document presented which claimed that a
20 Dutch consumer group claimed that they'd
21 found asbestos in baby powder.

22 Q. And you saw that in front of
23 the jury on the witness stand, correct?

24 A. I do remember seeing that,

1 yes.

2 Q. I couldn't find it. That's
3 why I was asking you the question.

4 MR. PLACITELLA: Can we go
5 back and put 263 in. And -- did
6 you put that in already? And how
7 about just "Dutch consumer group
8 found asbestos," and we'll give it
9 to Mr. Lanier. How's that?

10 THE WITNESS: The Dutch
11 consumer claimed to have found
12 asbestos.

13 MR. PLACITELLA: Oh, we'll
14 put -- so let's just go to the
15 first one. 263. Colorado School
16 of Mines, Vermont talc samples,
17 they used a centrifuge. And it
18 states, "Identified chrysotile at
19 a level of less than ten parts per
20 million in the Vermont sample."

21 BY MR. PLACITELLA:

22 Q. That's a quote, correct?

23 A. It is a quote. But in
24 isolation, it doesn't tell us whether it

1 had been deliberately added as part of
2 the method development when you were
3 looking to see how effective that method
4 could be. Okay. That's the point I'm
5 making. Is that --

6 Q. But --

7 A. -- on its -- -

8 Q. But that's your opinion,
9 sir. There's nothing -- there's no
10 contemporaneous document that you can
11 point to to say that's just you injecting
12 your opinion to try to change the facts,
13 right?

14 MR. LOCKE: Objection.

15 MR. SILVER: Objection.

16 MR. BICKS: I mean, I take
17 it you're telling us you haven't
18 looked at this underlying document
19 when you're asking those
20 questions.

21 MR. PLACITELLA: I'm
22 saying -- I'm asking you what's
23 reported here.

24 BY MR. PLACITELLA:

1 Q. Have you seen this document,
2 sir?

3 A. I have seen this document.

4 Q. Right.

5 A. When I look at this
6 document --

7 Q. I'm talking about the
8 December 21st, 1973 report to Mr. Ashton.
9 It doesn't say anything here in this
10 report about injecting asbestos or
11 spiking or anything else.

12 A. But in --

13 Q. You know what, I'm not going
14 to fight with you. I'll withdraw the
15 question.

16 A. Okay.

17 MR. PLACITELLA: Okay. Can
18 we put in the next line --

19 BY MR. PLACITELLA:

20 Q. Just leave it blank. Do you
21 know about what time the Dutch consumers
22 found -- do you remember what year it
23 was?

24 A. I can't remember.

1 MR. PLACITELLA: So we'll
2 just leave it blank. Put testing
3 entity, Dutch consumers. We'll
4 put -- and put over on test
5 revealed, put Baby Powder as the
6 product. That was the product.
7 That's it. And just put asbestos.

8 MR. BICKS: Objection.

9 THE WITNESS: I think in the
10 interest of fairness, it should be
11 claimed to have found asbestos.

12 MR. PLACITELLA: Claimed to
13 have found asbestos.

14 THE WITNESS: Thank you.

15 BY MR. PLACITELLA:

16 Q. Okay. Now give me 47.

17 (Document marked for
18 identification as Exhibit
19 J&J-47.)

20 (Document marked for
21 identification as Exhibit
22 J&J-49.)

23 BY MR. PLACITELLA:

24 Q. Exhibit 47 --

1 MR. PLACITELLA: Okay.

2 Exhibit 47 -- oh, somebody is
3 going to ask me what the Bates
4 number is. I -- it's covered.
5 Sorry.

6 BY MR. PLACITELLA:

7 Q. This is a June 6, 1973,
8 Johnson & Johnson letter to Mortimer,
9 Miller. Is that Roger Miller?

10 A. It's a guess. It's more
11 than likely to be Roger Miller.

12 Q. R. Miller. And cc'd is
13 Mr. Ashton?

14 A. Yes.

15 Q. And it's from a
16 Mr. Petterson at Johnson & Johnson,
17 correct?

18 A. Yes.

19 Q. All right. And he talks
20 about the concentration technique that
21 your consultant Dr. Pooley was using,
22 correct?

23 A. He's written that in the
24 letter, yes.

1 Q. All right. And the
2 concentration technique that Dr. Pooley
3 was using was not unlike that was used by
4 Colorado, which is he used a centrifuge,
5 correct?

6 A. He's used more than one
7 looking back through the correspondence,
8 he had more than one test methodology.
9 He was using a flotation method at one
10 point and centrifuging. Another
11 technique he had was to use a cationic
12 material that would -- a positively
13 charged chemical.

14 And so he's done more than
15 one type. So I'm not sure which one --
16 which test method it is. But it's
17 described as a concentration technique.

18 Q. Okay. So, and he states
19 that Shelley -- who is Shelley?

20 A. He was a research scientist
21 in baby products company.

22 Q. "Shelley reports that Pooley
23 found actinolite in our Vermont talc
24 using his concentration technique,"

1 correct?

2 A. That's what is written in
3 this memo, yes.

4 MR. PLACITELLA: Put that
5 in. That's Exhibit 47.

6 BY MR. PLACITELLA:

7 Q. We have 1973, the testing
8 entity was Cardiff, correct?

9 A. Yes.

10 Q. The author is Dr. Pooley,
11 right?

12 A. Yes.

13 Q. He used a concentration
14 technique and he found actinolite,
15 correct?

16 A. That is what is written in
17 that memo.

18 Q. Okay.

19 MR. PLACITELLA: Can you put
20 in as a recipient, Ashton.

21 BY MR. PLACITELLA:

22 Q. He's one of the recipients,
23 correct?

24 A. Yes.

1 MR. PLACITELLA: Okay. Give
2 me 141.

3 (Document marked for
4 identification as Exhibit
5 J&J-141.)

6 BY MR. PLACITELLA:

7 Q. 141 is another report -- I
8 shouldn't say another report.

9 A report from the University
10 of Cardiff dated January 25th, 1977,
11 correct?

12 A. Yes.

13 Q. And it's authored by
14 Dr. Pooley, correct?

15 A. Yes.

16 Q. He was working for you at
17 the time, correct?

18 A. Well, he's -- he is a
19 university professor. He did contract
20 projects, yes.

21 Q. Right. And what he did is
22 he tested a composite sample that you
23 supplied to him, correct?

24 A. Yes.

1 Q. From Vermont, correct?

2 A. Well, it's a composite
3 sample. I don't know where it came
4 from --

5 Q. Yeah, well, look at the
6 bottom here.

7 A. -- if it's from this --

8 Q. I'll blow it up.

9 A. Unless there's more detail.

10 Q. Do you see where it says
11 Vermont composite sample? I blew it up
12 for you.

13 A. Okay. Yes, I can see that
14 now.

15 Q. And what he found was fibers
16 of antigorite, correct?

17 A. That's what he wrote, yes.

18 MR. PLACITELLA: Okay. Can
19 we put that up, Lea.

20 BY MR. PLACITELLA:

21 Q. Okay. And here we have Dr.
22 Pooley, Cardiff, he used XRD for Vermont
23 composite. He found fibers of
24 antigorite, correct?

1 A. He has reported that in this
2 memo.

3 MR. PLACITELLA: Okay. Give
4 me 28.

5 (Document marked for
6 identification as Exhibit
7 J&J-28.)

8 BY MR. PLACITELLA:

9 Q. I know you've seen some of
10 these before, but I'm sorry. I have to
11 go through it. This one is an August 3,
12 1972 letter from Dr. Lewin.

13 You know that Dr. Lewin was
14 a consultant hired by the Federal Food
15 and Drug Administration, correct?

16 A. Yes.

17 Q. Okay. And you've seen this
18 document before?

19 A. Yes.

20 Q. Okay. And you know that
21 Dr. Lewin reported to the Food and Drug
22 Administration that he found chrysotile
23 asbestos in Shower to Shower, correct?

24 A. He claimed to have found it,

1 although that was not confirmed later,
2 but that's what he wrote in this memo.

3 Q. All I'm going to is what he
4 reported.

5 A. He reported in this memo,
6 his 19 -- sorry, 1972 memo, he reported
7 his findings.

8 MR. PLACITELLA: Can we put
9 that in, Lea, please.

10 BY MR. PLACITELLA:

11 Q. I have here that he worked
12 for NYU at the time, correct?

13 A. Yes. New York University.

14 Q. You have the author as
15 Dr. Weissler.

16 MR. PLACITELLA: That's not
17 correct. It should be flipped.

18 BY MR. PLACITELLA:

19 Q. Used XRD, Shower to Shower,
20 5 percent chrysotile, correct?

21 A. That's what he claimed.

22 MR. PLACITELLA: Okay. Now
23 give me 58.

24 (Document marked for

1 identification as Exhibit

2 J&J-58.)

3 BY MR. PLACITELLA:

4 Q. 58 you have seen before.

5 It's a March 1974 report?

6 A. I remember. I've seen that.

7 Q. Concerning Dartmouth

8 College, correct?

9 A. Yes, I've seen this before.
10 Yes.

11 Q. And the subject is analysis
12 of talc products and ores for asbestiform
13 amphiboles, correct?

14 A. That is the subject, yes.

15 Q. All right. And the purpose
16 of the study, according to this, is to
17 develop methods for measuring the
18 concentration of asbestiform amphiboles
19 in fine-grained talc products and ores,
20 correct?

21 A. Yes, it was an experiment
22 that they were doing in 1974.

23 Q. Similar to the Colorado
24 School of Mines, they were urging you to

1 use a pre-concentration method that
2 included a centrifuge, correct?

3 MR. BICKS: Objection to the
4 form.

5 THE WITNESS: I don't
6 believe they're urging the
7 company. What they're offering is
8 a study to develop methods and
9 methodologies that can be
10 evaluated.

11 BY MR. PLACITELLA:

12 Q. And according to Page 2, the
13 method they're proposing is using a
14 centrifuge, correct?

15 A. Yes.

16 Q. Okay. And what they looked
17 at was talc ore that was provided by
18 Windsor Minerals, correct? Ground talc
19 product from the talc ore, correct?
20 Actually they looked at the talc product
21 and the talc ore, correct?

22 A. They looked at talc ores and
23 talc property, yes. Yes.

24 Q. Okay. On Page 6 -- scratch

1 that. Let me just go to the next page.
2 What they found in their conclusions was
3 that the ore sample contained 2,300 parts
4 per million actinolite and the talc
5 product contained 170 parts per million
6 actinolite, correct?

7 A. Well, that's because they
8 added it. It says on Page 5, "In
9 addition talc ore was spiked with known
10 amounts of actinolite ground in size."
11 And then they they've got to see if they
12 can find it having spiked the talc.

13 Q. What they reported in their
14 conclusions is the ore contains
15 2,300 parts per million actinolite and
16 the talc product contains 170 parts per
17 million actinolite, correct, that's what
18 they report in their conclusion?

19 MR. SILVER: Objection.

20 THE WITNESS: Yes, but they
21 deliberately added on Page 5 --
22 that's my read of this that they
23 added known amounts of actinolite.
24 And that's a standard process when

1 you're looking -- see could you
2 find actinolite, you add it and
3 see if you can find it. That, to
4 my mind, when I read this, that
5 appears to be what they did.

6 BY MR. PLACITELLA:

7 Q. Sir, remember --

8 A. They were able to find it.

9 Q. Remember I told you that I
10 don't want your expert opinions. You're
11 not an expert. I want to know what was
12 reported. Give me what was reported.

13 MR. BICKS: He can read the
14 document. You just flashed it up
15 there highlighted it, and took it
16 down.

17 MR. PLACITELLA: Read to
18 me -- I won't take it down.

19 BY MR. PLACITELLA:

20 Q. "Conclusions, the ore
21 samples contain 2,300 parts per million
22 actinolite. And the talc product
23 contains 170 parts per million
24 actinolite. 3, actinolite is the

1 dominant fiber-form amphibole in the ore
2 and talc product provided by Windsor
3 Minerals. Small amounts of anthophyllite
4 may be present. That's what they report
5 here, correct?

6 A. You can't just take one
7 conclusion sentence in isolation.

8 The whole point of this
9 report, if we look at it in its full
10 context, talks about how -- in the
11 results, samples were spiked with
12 actinolite, were separated and analyzed.
13 Then they present the results. And then
14 the results, as you read out, was that
15 yes, they found it.

16 Q. And what they said, they
17 found it in the ore that was -- and the
18 product that was provided by Windsor
19 Minerals, correct? That's what they
20 said?

21 MR. SILVER: Objection.

22 THE WITNESS: The ore in the
23 product was provided by Windsor
24 Minerals. And as it says in the

1 results, just the top of Page 6,
2 "Samples of ore, an ore spiked
3 with actinolite, were analyzed and
4 described above." So they showed
5 they can find it when they
6 deliberately added it.

7 BY MR. PLACITELLA:

8 Q. Sir, I'm not going to debate
9 the science with you. You know what
10 happens here. What they do is they add
11 in a product, and then they see what
12 percentage -- you know that that's not
13 what happened here. So let's just talk
14 about what is reported. And we'll fight
15 about, at trial, what it means.

16 MR. SILVER: Objection.

17 BY MR. PLACITELLA:

18 Q. What they report here, sir,
19 is that in the Windsor product and ore,
20 they found fiber-form amphibole, which
21 was actinolite. That's what it states,
22 correct?

23 MR. LOCKE: Objection.

24 MR. BICKS: Objection to the

1 form.

2 BY MR. PLACITELLA:

3 Q. That's what it states?

4 A. Conclusion 2. "The other
5 samples contain 2,300 parts per million
6 of actinolite. And the talc product
7 contains 170 parts per million
8 actinolite.

9 Q. Conclusion 3, read
10 Conclusion 3?

11 A. "Actinolite is the dominant
12 fiber-form amphibole in the ore in the
13 talc product provided by Windsor
14 Minerals." But what I'm trying --

15 Q. But -- but -- sir --

16 MR. BICKS: You just want us
17 to read it.

18 BY MR. PLACITELLA:

19 Q. You read it.

20 A. I read it.

21 Q. That's fine. Thank you.

22 MR. PLACITELLA: Can you go
23 to the chart. I want to put a
24 note next to it, okay, so we are

1 all on the same page.

2 BY MR. PLACITELLA:

3 Q. Dartmouth College. "The
4 purpose was to develop methods for
5 measuring the concentration of
6 asbestiform amphiboles, it was a talc
7 product and ore. There was ore in the
8 product. They used a centrifuge and they
9 reported actinolite and talc products
10 contains 170 parts per million
11 actinolite, small amounts of
12 anthophyllite may be present.

13 MR. PLACITELLA: And we'll
14 put next to it, put in the next
15 category, "Dr. Hopkins has issues
16 with spiking in terms of
17 conclusions."

18 BY MR. PLACITELLA:

19 Q. Is that fair?

20 MR. BICKS: Objection to the
21 form.

22 MR. LOCKE: Objection.

23 BY MR. PLACITELLA:

24 Q. Tell me what you want me to

1 write there?

2 A. I have issues with the
3 conclusions in the context that the study
4 involved spiking.

5 MR. PLACITELLA: Okay. So
6 let's just put he has issues with
7 the conclusions.

8 THE WITNESS: With the
9 reason, please.

10 BY MR. PLACITELLA:

11 Q. Okay. So you believe, just
12 so we know, that the conclusions mean
13 that it was spiked and never found in the
14 ore?

15 A. That was not clear from the
16 report.

17 Q. Okay.

18 A. The whole purpose of that
19 report was to develop methodologies. And
20 when you develop methodologies, it is the
21 usual, to deliberately add 1 percent or
22 whatever it may be, to say can I find it.

23 That is not clear from that
24 conclusion. It doesn't say we added 1

1 percent and we found it. It's a study
2 where they deliberately spike, and then
3 they say we found it in the conclusion.

4 Q. Okay.

5 A. So it's not entirely clear.

6 Q. Okay. But it certainly
7 doesn't say we found anthophyllite --
8 actinolite -- fibrous actinolite because
9 we spiked it. It doesn't say that right?
10 We know that's not what it says?

11 MR. LOCKE: Objection.

12 MR. BICKS: Object to the
13 form.

14 THE WITNESS: It doesn't --

15 BY MR. PLACITELLA:

16 Q. Now, they spiked this with 1
17 percent, right?

18 A. I don't know. Does it say
19 one percent?

20 Q. Isn't that what you said?

21 A. What I said is it's often
22 usual to spike with 1 percent, or
23 whatever it may be.

24 Q. You don't know how much they

1 spiked it with?

2 A. It doesn't make it clear in
3 that report. I need to look at it in
4 great detail. But they do say they spike
5 it. So that was the point that I'm
6 making, is that when we have a
7 conclusion, we need to see it in the
8 total context.

9 Q. I understand that.

10 A. Total context is, are they
11 measuring what they spiked or were they
12 not measuring what they spiked. It's not
13 clear.

14 Q. Okay. Nowhere in the
15 conclusion does it say that when we found
16 the fibrous actinolite, we found it
17 because it was spiked, that's absent from
18 the conclusion, correct?

19 A. It's absent from the
20 conclusion.

21 Q. Okay. Thank you.

22 A. But you've got to see the
23 whole context of the whole report.

24 MR. PLACITELLA: Okay. Give

1 me 29.

2 (Document marked for
3 identification as Exhibit
4 J&J-29.)

5 BY MR. PLACITELLA:

6 Q. 29 is an August 24, 1972 --

7 MR. PLACITELLA: Sorry, did
8 I give you have a copy? Sorry. I
9 apologize.

10 BY MR. PLACITELLA:

11 Q. -- memo from Mr. Nashed to
12 Mr. Fuller. And the title is,
13 "Talc/asbestos Shower to Shower talc,"
14 correct?

15 A. Yes.

16 Q. Okay. And on the back,
17 you -- it's copied to a whole bunch of
18 scientists and executives at Johnson &
19 Johnson, correct?

20 A. Yes, there are.

21 Q. And what this document talks
22 about is the testing that was done
23 initially by Dr. Lewin, correct?

24 A. Yes. It's a follow-up.

1 Yeah.

2 Q. And what happened then was
3 that after Dr. Lewin ran the test, the
4 FDA sent out the test to another
5 laboratory known as Sperry Rand, correct?

6 A. Well, I don't know whether
7 FDA sent the sample. But Sperry Rand
8 reported on it, yes.

9 Q. All right. And what's
10 reported here by your senior scientist is
11 as follows:

12 "The report from Sperry Rand
13 was that asbestos fibers could be
14 detected in the sample." Correct?

15 A. That is what is written.

16 Q. "Dr. Weissler" -- he's from
17 the FDA, correct?

18 A. He is, yes.

19 Q. -- "said that he has in
20 front of him photographs of six fields at
21 12,000X magnification showing fibers with
22 length, width -- width and length
23 ratios."

24 Do you see that?

1 A. Yes.

2 Q. Okay. The next paragraph
3 talks about a conversation that
4 Mr. Nashed had with Dr. Weissler at the
5 FDA.

6 Do you see that?

7 A. Yes.

8 Q. And what Dr. Weissler told
9 Mr. Nashed is Sperry Rand is experienced,
10 and they do a lot of work with
11 chrysotile, correct?

12 A. That's what he stated.

13 Q. Right and he says, "The man
14 at the FDA reported to Mr. Nashed that
15 the scientists at Sperry Rand are
16 conservative and would not have reported
17 chrysotile unless he was true" -- "unless
18 he was sure." Correct?

19 A. You read what was written.

20 Q. All right. He said, "I
21 asked him if he was" -- "if he has
22 assured himself that the fibers were not
23 tremolite which could be present in trace
24 amounts. He said the fibers are

1 characteristic of chrysotile and not
2 tremolite."

3 Did I read that correctly?

4 A. You read what was written.

5 Q. Okay. And that's what was
6 reported to all these executives at
7 Johnson & Johnson in August 1972,
8 correct?

9 A. That's -- that's reported to
10 those people, yes.

11 Q. Okay. So I put down there
12 "8/24/1972, Sperry Rand hired by the FDA.
13 The author of this memo was Mr. Nashed.
14 FDA submits Lewin sample. It's Shower to
15 Shower. Asbestos fibers could be
16 detected in the sample, reported
17 chrysotile."

18 That's what it states,
19 correct?

20 A. It does, except I'm not sure
21 that FDA hired Sperry Rand. I don't see
22 that here, sir.

23 MR. PLACITELLA: Okay.

24 We'll take out hired.

1 THE WITNESS: Yeah.

2 MR. PLACITELLA: Okay. Give
3 me 71.

4 Give me 258.

5 (Document marked for
6 identification as Exhibit
7 J&J-258.)

8 BY MR. PLACITELLA:

9 Q. 258. I'll put it up.

10 MR. BICKS: Do you have a
11 copy of it?

12 MR. PLACITELLA: It's big so
13 I didn't -- I'm happy to come back
14 to it if you need time to look at
15 it. I'll do another one. Totally
16 up to you.

17 Just make a note, Lea.
18 We'll come back to that. Give
19 that one to Peter because he's --

20 MR. BICKS: No, I'm familiar
21 with it.

22 MR. PLACITELLA: Okay. He
23 knows it. Let's deal with it.

24 BY MR. PLACITELLA:

1 Q. So 258 is a September 6,
2 1973 project from a project manager, a
3 John Stuart. Who is John Stuart?

4 A. My read of this is it's
5 someone at FDA.

6 Q. Okay.

7 A. But I'm not sure.

8 Q. Okay. Have you ever seen
9 this before?

10 A. I've seen something similar.
11 I think this is an FDA document.

12 Q. Right. And the objective
13 here is, "To develop one or several
14 methods of sufficient sensitivity and
15 reliability, which will permit the
16 determination of asbestos and other
17 contaminants in talc-containing
18 products."

19 Do you see that?

20 A. I do, yes.

21 Q. Because they may
22 potential -- present a potential hazard,
23 right?

24 A. That was the discussion back

1 in '73, yes.

2 Q. Right.

3 A. Test methods.

4 Q. And what he did is he went
5 and he got the samples that were tested
6 by Dr. Lewin, correct?

7 A. Without reading the whole
8 report, if you can point me to which --

9 Q. So it's the, "200 commercial
10 cosmetic talc samples will be tested for
11 asbestos by refraction." He talks about
12 testing the Lewin samples right under the
13 description of work.

14 A. Yes, he does.

15 MR. SILVER: Note Imerys'
16 continuing objection. I have a
17 standing objection. This document
18 says it's for aerosols and air
19 preparations.

20 The scope of this deposition
21 is supposed to be related to
22 Johnson's Baby Powder.

23 MR. PLACITELLA: I'm going
24 to get there.

1 MR. SILVER: Okay.

2 BY MR. PLACITELLA:

3 Q. And if you go to -- where it
4 says Project Number 0069.

5 A. Yes.

6 Q. Okay. And you see on the
7 bottom?

8 MR. BICKS: 00679.

9 BY MR. PLACITELLA:

10 Q. Right. That it the project
11 manager signature is John Stuart.

12 Do you see that?

13 A. Yes.

14 Q. And the program manager is
15 Heinz Eirmann. He worked for the FDA,
16 correct?

17 A. He did, yes.

18 Q. Okay. And on the next page
19 he talks about looking at Sample 84 from
20 the Lewin samples.

21 Do you see that?

22 A. Yes.

23 Q. You know Sample 84 was a
24 Johnson & Johnson product, correct, from

1 the Lewin samples? You remember that?

2 A. Yeah, I don't remember it.

3 But I'll take your word for it.

4 Q. Okay. It was in Exhibit 28.

5 Do you see where it says example

6 number -- "Sample Number 84 contained

7 fibers of tremolite/actinolite"?

8 A. Yeah, I can read what is

9 written. Yes. Okay. What they are

10 quoting is Dr. Lewin's report though, as

11 of 12/21/73. Samples, Dr. Lewin's

12 identification. And then he describes

13 what my read of that is, what Dr. Lewin

14 found.

15 Q. Okay.

16 A. He's reporting Dr. Lewin's

17 comments, not FDA's comments.

18 Q. Okay. And the process that

19 they are examining here is again a

20 pre-concentration process, correct?

21 A. I'm aware they were working

22 on a concentration method, yes.

23 Certainly aware of that.

24 MR. PLACITELLA: Can you

1 give me Exhibit 33, please.

2 (Document marked for
3 identification as Exhibit
4 J&J-33.)

5 BY MR. PLACITELLA:

6 Q. Exhibit 33 is a report from
7 the University of Minnesota Space Science
8 Center. You've seen this before,
9 correct?

10 A. Yes.

11 Q. And the University of
12 Minnesota is that someone that Johnson &
13 Johnson hired to look at the samples that
14 were tested by Dr. Lewin, correct?

15 A. No. Not correct, no. My
16 understanding is that they were requested
17 by, I think it was RJ Lee to maybe
18 McCrone -- McCrone, sorry -- to examine.
19 But it was not Johnson & Johnson.

20 Q. All right. Well, you hired
21 McCrone, and McCrone hired them, right?

22 A. Well, McCrone asked them for
23 some input.

24 Q. Right. And they issued this

1 report, which eventually made it to your
2 headquarters, correct?

3 MR. BICKS: Objection to the
4 form.

5 THE WITNESS: Obviously if
6 it's in the J&J files, then it
7 would have made it to Johnson &
8 Johnson.

9 BY MR. PLACITELLA:

10 Q. Okay. And what they did is,
11 if you look at the very beginning, is
12 they looked at specimens of powdered talc
13 that were received from you and McCrone
14 and did an analysis to determine whether
15 the samples contained chrysotile
16 asbestos, correct?

17 A. They -- they reported their
18 findings on x-ray diffraction. I think
19 it was here. They reported their
20 findings.

21 Q. All right. And --

22 A. I need to read this to find
23 out what processes they used, what
24 methods they used.

1 Q. Well, go to Page 3 of the
2 report.

3 A. Well, they used scanning
4 electron microscope.

5 Q. They also used TEM, correct?

6 A. They used TEM, yes.

7 Q. Right. And when they looked
8 at your samples using TEM, they found
9 numerous examples of fibrous material,
10 correct?

11 A. They found -- three examples
12 of fibers, which upon examination by
13 electron diffraction could be classified
14 as likely candidates of chrysotile
15 asbestos.

16 So it was -- it's -- the
17 wording is a little nebulous. It could
18 be classified, but it's what is written.

19 Q. In the Shower to Shower
20 material, correct?

21 A. They say "candidates that
22 could be classified."

23 Q. So in the Shower to Shower
24 material and the Lewin material, correct?

1 So they looked at your samples, and they
2 looked at Lewin's samples and they --
3 under TEM, and they said that they were
4 likely candidates for chrysotile
5 asbestos, correct?

6 MR. BICKS: Objection.

7 THE WITNESS: Well, I don't
8 know whether they looked -- I
9 don't know whose they looked at.
10 It just says that they looked at
11 the Lewin samples.

12 BY MR. PLACITELLA:

13 Q. No. Look at it. It says,
14 "Of the large number of grids examined,
15 three examples of fiber upon which
16 examination by electron diffraction could
17 be classified as likely candidates for
18 chrysotile asbestos in the Shower to
19 Shower material and one example was found
20 in the Lewin material," correct?

21 A. You read what was written.
22 Yes.

23 Q. Okay. And then on the next
24 page. They report that the electron

1 micrographs showed a typical appearance
2 of chrysotile asbestos, correct?

3 A. Well, that's what they've
4 written. But they don't have the ability
5 to spell chrysotile properly. But
6 they've written electron micrographs show
7 the typical appearance of chrysotile
8 asbestos.

9 Q. Well, they do more than
10 that. They say, do they not, "It is
11 felt, therefore, that chrysotile asbestos
12 does exist in the specimens of Shower to
13 Shower and Lewin supplied to this
14 laboratory," correct?

15 A. That is what is written.
16 Yes.

17 MR. PLACITELLA: Can we --
18 go to the next one, yep.

19 BY MR. PLACITELLA:

20 Q. Here we have University of
21 Minnesota, Shower to Shower, chrysotile,
22 "Chrysotile asbestos does exist in the
23 specimens of Shower to Shower." Correct?
24 That's what's reported?

1 A. You read what is written in
2 that Minnesota report.

3 Q. Okay. In 1971, are you
4 aware that Dr. Langer tested Johnson's
5 Baby Powder and found chrysotile
6 asbestos?

7 A. He claimed to have found
8 chrysotile asbestos by the methods he was
9 using at the time. Yes.

10 Q. So let me ask the question
11 this way.

12 In 1971, Dr. Langer of the
13 Mount Sinai School of Medicine reported
14 to Johnson & Johnson that the Johnson's
15 Baby Powder contained chrysotile
16 asbestos, correct?

17 MR. BICKS: Objection to the
18 form.

19 THE WITNESS: I would need
20 to see the actual report.

21 MR. PLACITELLA: Give me 17.
22 I was trying to speed this up.
23 But I guess not.

24 (Document marked for

1 identification as Exhibit

2 J&J-17.)

3 BY MR. PLACITELLA:

4 Q. Exhibit 17 is a -- it's JNJ
5 and it ends with 6743.

6 It discusses a meeting that
7 you had with Dr. Langer on July 9th,
8 1971, correct?

9 A. It does, yes.

10 Q. Okay. And what Dr. Langer
11 was asked to do was to look at tissue
12 samples from a study that was done in
13 Europe where they found talc in the
14 women's ovaries?

15 A. It said uterus -- it says
16 uterus here.

17 Q. Right.

18 A. It's -- yeah.

19 Q. And that was something that
20 he was actually doing for you, right? I
21 mean, you know this story.

22 MR. BICKS: Langer?

23 Dr. Langer.

24 MR. PLACITELLA: Yeah.

1 BY MR. PLACITELLA:

2 Q. Right.

3 MR. BICKS: Objection to the
4 form.

5 THE WITNESS: I don't know
6 who -- whether he was doing it --
7 whether he was doing it for the
8 operation, the Tenovus Institute
9 which is in Wales. They are the
10 ones who found it.

11 My reading here is that --
12 it says, "The express purpose was
13 to observe the preparation of
14 tissue from the Tenovus Institute
15 for electron microscope
16 examination."

17 So that doesn't exclude the
18 possibility that the Tenovus
19 Institute, the scientists there,
20 were dealing directly with
21 Dr. Langer.

22 BY MR. PLACITELLA:

23 Q. Okay. So how did you get a
24 meeting then with Dr. Langer then if he

1 was dealing with them?

2 A. Well, I think the answer is
3 if you go onto the next section, he's
4 looking at Johnson's Baby Powder. That's
5 on Page Bates Number 45.

6 Q. Right. So he was, one,
7 looking at the women's ovaries, correct?

8 A. It says uterus here.

9 Q. And what he did is he found
10 chrysotile asbestos in the -- in the
11 uterus, right?

12 A. I don't see it actually says
13 he found -- found that. It talks about
14 his test methods, his methodologies. I
15 can't see the conclusion where it says he
16 found asbestos.

17 Oh, it does, yeah. It says
18 he could identify -- "Dr. Langer claimed
19 to identify as chrysotile. This method
20 is based on the experience observing
21 fibers of chrysotile under similar
22 experimental conditions."

23 Q. And then he used an electron
24 microscope and a light microscope to

1 actually look at the Johnson's Baby
2 Powder, correct?

3 A. That was his test
4 methodology, yes.

5 Q. Right. And he worked for
6 Dr. Selikoff at Mount Sinai, correct?

7 A. He did, yes.

8 Q. And Dr. Selikoff was
9 considered one of the foremost
10 authorities in the world on asbestos,
11 correct?

12 A. Yes, that is correct. On
13 asbestos, on health issues to employees
14 from that aspect, yes.

15 Q. And what Dr. Langer found
16 was that when he looked at the Baby
17 Powder, he found asbestos, right?

18 A. Well, he -- he uses the
19 words -- In Johnson's product, he
20 estimated particles to be fibrotic, in
21 which some could be 'asbestos.'

22 So he's not actually saying
23 they were asbestos, but they could be
24 asbestos, in quotes.

1 Q. Oh, really, because I'm
2 looking at the page that says -- and I
3 blew it up here. "Using electron
4 microscopy, Dr. Langer has demonstrated
5 to me" -- that's the person who met with
6 him, correct?

7 A. Yes.

8 Q. The Johnson & Johnson
9 executive that went up to his laboratory
10 to see what he's up to?

11 A. That is the read, yes.

12 Q. Okay. It says, "Dr. Langer
13 has demonstrated to me the presence of
14 some very fine fibers at moderately high
15 magnification which he identifies as
16 chrysotile asbestos by the typical
17 tubular appearance of the fiber."

18 Correct?

19 A. That is -- that is what is
20 written. Yes. That's what he wrote in
21 1972.

22 Q. And in the conclusion, in
23 the summary that was written by your
24 scientists, they put, in the fourth

1 conclusion in the summary, "Electron
2 microscopy" -- that's what you had
3 specified, right, 7024, using electron
4 microscope. I'll withdraw that question.

5 "Electron microscopy at high
6 magnification shows a few fibers to be
7 present in Johnson's Baby Powder, which
8 can be identified with chrysotile
9 asbestos according to Dr. Langer,"
10 correct?

11 A. You read -- you read what
12 was written. Yes.

13 Q. Okay. Can we put that up,
14 please. We have here 1971. Mount Sinai,
15 Dr. Langer, TEM, Johnson's Baby Powder,
16 chrysotile asbestos.

17 A. You said TEM. It doesn't
18 specify whether it was TEM or SEM. It
19 just says -- at least that's my read. It
20 says electron microscopy.

21 MR. PLACITELLA: Okay.

22 Let's just say -- let's just
23 change it to electron microscopy.
24 I want to be exact.

1 THE WITNESS: Again, in the
2 interest of accuracy, it does say
3 "which can be identified with
4 chrysotile." It doesn't -- in my
5 read, that doesn't confirm it
6 110 percent.

7 MR. BICKS: Do I see 1971 on
8 it?

9 THE WITNESS: No, I thought
10 this was '71. It doesn't say.

11 MR. PLACITELLA: July 9th.
12 I guess we'll figure out -- figure
13 out we'll make sure the date is
14 right overnight.

15 Now, do you have 92?

16 (Document marked for
17 identification as Exhibit
18 J&J-92.)

19 MR. BICKS: The author can't
20 be Langer, right?

21 MR. PLACITELLA: No, it's
22 you guys.

23 MR. BICKS: Okay. Because
24 the author that you have on the

1 chart is Langer.

2 MR. PLACITELLA: Change
3 that.

4 MR. BICKS: Do we know who
5 wrote it?

6 BY MR. PLACITELLA:

7 Q. I'm just going to show you
8 Exhibit 92. You've seen this before.
9 I'm sorry.

10 By the way, in that last
11 document, can you help figure out
12 overnight actually who wrote it? Because
13 I couldn't tell.

14 MR. BICKS: I know
15 Dr. Egilman is coaching you.

16 MR. PLACITELLA: No, he was
17 not really. No actually he was
18 asking me -- he was asking me
19 where we were going to dinner
20 tonight. How's that?

21 MR. BICKS: We're not
22 going --

23 MR. PLACITELLA: He wants to
24 know if I'm buying him dinner.

1 MR. BICKS: We're not going
2 to do assignments for you tonight.

3 THE WITNESS: If I knew I'd
4 tell you today.

5 BY MR. PLACITELLA:

6 Q. Okay. Great?

7 A. I don't know, and I'm
8 probably never going to find out, because
9 a number of J&J scientists met with
10 people like Langer. That's part of the
11 thing. Scientists talk to each other.
12 And I don't know who that scientist was.

13 Q. Now, Dr. Langer told you,
14 actually on more than one occasion doing
15 different sampling that he found asbestos
16 in your products, correct?

17 A. He -- well, this letter
18 actually uses the words that I was going
19 to. "Langer's claiming that he's
20 detected chrysotile and amphiboles."

21 Q. You're talking about the --
22 now we are on the September 9, 1975
23 letter, correct?

24 A. We are, yes.

1 Q. And this is a letter from
2 Mr. Lee, copying Mr. Ashton and a bunch
3 of other people, correct?

4 A. Yes.

5 Q. And he's talking about a
6 telephone call he received from
7 Dr. Pooley, correct?

8 A. The telephone call was from
9 Bob Dean, who was research director in
10 the UK.

11 Q. To report a call he got from
12 Bob -- from Pooley?

13 A. From Dr. -- Professor
14 Pooley, yes.

15 Q. Because what happened was
16 that Pooley and Langer were supposed to
17 publish a -- to give a talk on what they
18 found when they looked at Johnson's Baby
19 Powder. Do you remember that?

20 A. I'm aware of that, yes.

21 Q. But Johnson & Johnson kind
22 of got in the way of that and stopped
23 that from happening, right?

24 MR. BICKS: Objection to

1 form.

2 THE WITNESS: No, that's
3 not -- that's not correct.

4 Professor Pooley was in
5 disagreement with Dr. Langer.

6 BY MR. PLACITELLA:

7 Q. You sure you had nothing to
8 do with it? No input? Are you sure that
9 you had nothing to do with Dr. Pooley and
10 interfering with the publication of the
11 paper?

12 A. Professor Pooley is a man
13 that you would not want to cross. He
14 would tell you where to go if he thought
15 you were trying to interfere.

16 Q. Actually, I thought the last
17 time we were here when I was deposing
18 you, he was very nice. He told me where
19 the bathroom was. He didn't tell me
20 where to go. So now, and I think
21 Mr. Bicks was in the other room with
22 Mr. Lanier.

23 So I'm looking at this
24 letter. And I just want to know what was

1 reported.

2 And what's reported is that
3 Langer has looked at your products and
4 found chrysotile and amphiboles, correct?

5 A. Well, the letter says Langer
6 is claiming that he's detected chrysotile
7 and amphiboles. And he's detected
8 tremolite and anthophyllite in Baby
9 Powder. That's what Langer is claiming.

10 Q. Right. I'm asking -- I'm
11 telling you, or we're discussing here
12 what was reported to Johnson & Johnson.

13 A. Yeah. That was what was
14 reported.

15 Q. What was reported was that
16 Langer was going to give a talk that,
17 based upon his examination of the
18 Johnson's Baby Powder, he found tremolite
19 and anthophyllite asbestos and chrysotile
20 in your products, correct?

21 A. And that was -- the word is
22 he claimed that he had found it back in
23 '75, yes.

24 Q. Right. Okay. Now --

1 MR. PLACITELLA: Hold that.
2 We'll do two at the same time.
3 Give me 177.

4 (Document marked for
5 identification as Exhibit
6 J&J-177.)

7 BY MR. PLACITELLA:

8 Q. 177 is a May 3, 1984 memo
9 entitled "MSHA Visit"?

10 Do you see that?

11 MR. SILVER: Objection to
12 form.

13 MR. PLACITELLA: And I'm
14 going to give you the Bates number
15 or the -- it's marked on the
16 bottom Herford 119. Do you see
17 that, on the bottom?

18 THE WITNESS: Yes.

19 MR. PLACITELLA: Okay.

20 MR. SILVER: Chris, just for
21 the record I think you said it is
22 a May 3 document. I think it's a
23 May 15 document.

24 MR. PLACITELLA: Correct.

1 I'm sorry.

2 BY MR. PLACITELLA:

3 Q. It's a May 15, 1984
4 describing a visit of May 3, 1984.

5 Do you see that?

6 A. Yes.

7 Q. Okay. And the MSHA is the
8 Mine Safety and Health Administration,
9 correct?

10 A. Yes.

11 Q. And you've seen this
12 document before, correct?

13 A. I believe I have, yes.

14 Q. Right. And what happened
15 was at the mine safety and health
16 administration actually visited the
17 facility in South Plainfield where the
18 talc that was used in Baby Powder was
19 being processed, correct?

20 MR. LOCKE: Objection.

21 THE WITNESS: It says the
22 people are monitored by the Mine
23 Safety and Health Admin, yes.

24 BY MR. PLACITELLA:

1 Q. Right. And what they
2 actually did is they went in to see were
3 the people who were working in that
4 facility at some kind of health risk,
5 correct?

6 A. Yes, yes.

7 Q. And what was reported was
8 that there was 71.2 percent fibrous talc,
9 5.8 percent anthophyllite, which was
10 concluded to be an asbestiform amphibole,
11 correct?

12 MR. SILVER: Objection to
13 form.

14 THE WITNESS: We're talking
15 about the filters, the personal
16 air filters that people were
17 wearing --

18 BY MR. PLACITELLA:

19 Q. Correct.

20 A. -- themselves.

21 This is written by, I don't
22 know who K.W. Olson, Ph.D., is in this.
23 But that is what is reported, that they
24 found that. And this individual has

1 described the anthophyllite as an
2 asbestiform amphibole. But I have not
3 seen that in the MSHA results.

4 Q. Then it says in 3, "In the
5 case of CIMC's sample."

6 Do you see that, where it
7 talks about what they looked at?

8 A. Yes.

9 Q. They say they found -- they
10 actually count the fibers. And they say
11 they found fibrous talc, and that's where
12 they get the percentage of fibers.

13 Do you see that?

14 A. Yes.

15 Q. And do you see where they
16 say they found anthophyllite asbestos?

17 A. I read that, yes. Although
18 what this doesn't say is which -- which
19 mine they visited. Which facility.

20 Q. Well, it says the South
21 Plainfield facility, doesn't it? Right
22 at the top, the South Plainfield mill,
23 the very first sentence?

24 A. It does say that. But I

1 don't know whether that was an industrial
2 mill or how far away that is from the
3 Hammondsville mine and milling operation.

4 Q. You didn't know that they
5 processed your Baby Powder right here in
6 New Jersey in South Plainfield?

7 A. What I want to say is I
8 don't know whether that was the -- that
9 particular mill was operating as Baby
10 Powder, I don't know, or was it a mill
11 that was looking at industrial talcs. I
12 don't know.

13 Q. You don't know, but somebody
14 knows?

15 A. Well, this was 40 years ago,
16 30 years ago, yes.

17 Q. Okay. And if you go on the
18 next page, it talks about who did the
19 tests, right? And that they sent -- and
20 they took photographs of the patterns to
21 document what they found, right?

22 A. Yes.

23 Q. Okay. If you go down to the
24 report under where it says trip report.

1 Do you see that?

2 A. Which Bates page?

3 Q. When they are actually
4 analyzing how complete this study
5 actually was.

6 A. Which page, please? Bates
7 number?

8 Q. Bates Number 121?

9 A. 121. Thank you.

10 Q. First, if you go to 121, and
11 they say the analysis was very complete,
12 and that the testing scheme he used had
13 actually already been tested in court,
14 correct?

15 A. Yeah, that's what's written,
16 yes.

17 Q. They say, according to the
18 federal government, a false positive
19 analysis for asbestos was not possible
20 using this scheme, correct?

21 A. That is what is written.
22 But again, I'm coming back to this
23 question as to how on earth does this tie
24 into Johnson's Baby Powder. I am just

1 not aware of any milling operation in
2 South Plainfield.

3 Q. Well, you know that they
4 were looking at Italian talc when they
5 did this?

6 A. Who is they?

7 Q. The Mine Safety and Health
8 Administration. Do you know that they
9 used Italian talc here?

10 MR. BICKS: Objection to
11 form. No foundation.

12 BY MR. PLACITELLA:

13 Q. Did you know that?

14 A. Well, it mentions Italian
15 talc. But this is a Cyprus Mineral
16 report or a report to a Cyprus Mineral
17 facility. And the point that I'm making
18 here is that J&J was not using Italian
19 talc in Baby Powder in 1984.

20 Q. Well, did the mine change
21 somehow from when you were using it? I
22 thought you said the geology was all the
23 same?

24 A. Italian talc.

1 Q. Yeah. Why would this be any
2 different than the talc you were buying?

3 MR. BICKS: Objection to the
4 form.

5 MR. SILVER: Objection to
6 the form.

7 THE WITNESS: I'm not aware
8 that we were buying Italian talc
9 in 1984.

10 BY MR. PLACITELLA:

11 Q. But you were buying it in
12 1980, right?

13 A. We bought in 1980 for a
14 period of two months. I think January,
15 February 1980. Possibly December 1979
16 during the mine strike, a small quantity
17 of Italian talc was used for about
18 12 weeks.

19 Q. Okay. So in terms of the
20 man's credentials who did this testing,
21 if you go to 122, this is what your
22 supplier that you relied upon said about
23 the man's credentials.

24 "He is a certified

1 technician, an experienced microscopist,
2 and has served as an expert witness and a
3 friend of the court during the
4 various" -- "course of various
5 litigations." Right?

6 A. Yes, that's what's written.

7 Q. So he obviously knew what
8 the heck he was talking about, right?

9 MR. BICKS: Objection to
10 form.

11 THE WITNESS: Again, it
12 comes around to the question of
13 what's the connection with
14 Johnson's Baby Powder from a mill,
15 a Cyprus mill in South Plainfield.

16 BY MR. PLACITELLA:

17 Q. Well, we'll connect that up
18 at a different point in time?

19 A. I don't even know which
20 South Plainfield this is. Is it in New
21 Jersey or is it another South Plainfield?

22 Q. Okay.

23 MR. LOCKE: Can we take a
24 quick break.

1 MR. PLACITELLA: Yeah, sure.

2 THE VIDEOGRAPHER: Stand by
3 please. The time is 4:42 p.m. We
4 are going off the record.

5 (Short break.)

6 THE VIDEOGRAPHER: The time
7 is 4:56 p.m. We are back on the
8 record.

9 BY MR. PLACITELLA:

10 Q. Okay. Just the last entry
11 on this chart, the Mine Safety and Health
12 Administration analysis for asbestiform
13 materials was Italian talc, air samples
14 at Cyprus South Plainfield, 71.2 percent
15 fibrous talc, and 5.8 percent
16 anthophyllite and asbestiform amphibole.

17 And I understand and the
18 record reflects that your point is that
19 at this point we don't know if that was
20 the actual talc that went into the
21 Johnson Baby Powder, correct?

22 A. That is my point. And the
23 point being that there are many different
24 Italian talcs.

1 MR. PLACITELLA: So give me
2 257.

3 (Document marked for
4 identification as Exhibit
5 J&J-257.)

6 BY MR. PLACITELLA:

7 Q. 257. I'm sorry. Did I say
8 257? Yeah. 257 is a report with the
9 Bates number ending -- 8893.

10 And it is entitled "Italian,
11 medicated, Grantham talc from R. Rolle
12 files." Who is R. Rolle?

13 A. That would Bob Rolle or
14 Robert Rolle, who is a scientist in the
15 baby product company.

16 Q. Okay. And if we can go --
17 and the next page is a cover letter from
18 McCrone Associates dated September 3rd,
19 1971. "Enclosing a report on the
20 Grantham ore and Shower to Shower and
21 medicated powders."

22 Do you see that?

23 A. Yes.

24 Q. Okay. And if you go to Page

1 2 of the report itself, McCrone reports
2 that in the medicated powder, we found
3 one fiber of chrysotile.

4 Do you see that?

5 A. He said he's examined the
6 G-11 sample, which is the Grantham ore
7 sample, it is my understanding.

8 Q. No, no. Up further,
9 Dr. Hopkins.

10 A. Which page are you on, 2?

11 Q. Same page, up where it says,
12 "In the medicated powder."

13 A. Sorry. Are you on Page 1?

14 Q. No, Page 2.

15 A. Bates number 95?

16 Q. 98.

17 A. 98. That helps.

18 Q. Okay. Sorry.

19 A. Yes.

20 Q. In the medicated powder they
21 found one fiber of chrysotile, correct?

22 A. That's what they reported.
23 That's what they wrote, yes.

24 Q. And in the Shower to Shower

1 sample, they say they found several
2 fibers and they feel very strongly that
3 they may be chrysotile, but at a very low
4 percentage, correct?

5 A. Well, it says they found
6 several fibers, which do not show the
7 coring typical of chrysotile. Chrysotile
8 fibers under microscope look like a core,
9 like a tube. They may be finding fibers
10 of talc.

11 "We're unable to obtain the
12 diffraction pattern but feel strongly it
13 may be chrysotile. Again, very low."

14 So they are hedging their
15 bets on that one.

16 Q. Right. But what they say is
17 on one method, you know, we don't see it.
18 We use another method. But we feel
19 pretty strongly it's chrysotile, right?

20 A. They say it may be
21 chrysotile.

22 Q. And they spell chrysotile
23 correct?

24 A. They do indeed. They appear

1 to know what they are talking about.

2 But they say in the first
3 sentence -- first part of that sentence,
4 it doesn't show the coring of chrysotile.
5 And then they go onto say, well, this is
6 fiber, it may be chrysotile.

7 Q. Okay. Now, going to --

8 MR. PLACITELLA: Give me 23,
9 and then we'll do two together.

10 BY MR. PLACITELLA:

11 Q. Seven months later, they
12 look at the medicated powder and Shower
13 to Shower, right?

14 (Document marked for
15 identification as Exhibit
16 J&J-23.)

17 BY MR. PLACITELLA:

18 Q. This is Walter McCrone on
19 October 12, 1971.

20 Do you see that?

21 A. Yes. One month later.

22 Q. If you go to Page 3 under
23 Shower to Shower, they say, "The fiber
24 content of Shower to Shower is quite

1 low," correct?

2 A. That is what is written.

3 Q. Okay. On the next page he
4 says, "We have, however, found traces of
5 chrysotile in G-11."

6 Do you see that?

7 A. Yes.

8 Q. And G-11 is from the
9 Grantham mine?

10 A. Yes. That was -- that was a
11 mine that was never actually used. But
12 it was being evaluated as an option at a
13 point as a case, or as of when
14 Hammondsville ran out of talc. It was an
15 evaluation project.

16 Q. Well, it says here, one of
17 the additives to Shower to Shower?

18 A. Oh, in that case -- are we
19 talking about Grantham ore or the
20 additives.

21 Q. G-11.

22 A. I thought you said Grantham.
23 G-11 is an additive, yes.

24 Q. When you say additive, what

1 do you mean by that?

2 A. I'm not sure what that was.
3 It could have been an antiseptic or
4 whatever the -- there is an additive
5 G-11.

6 Q. So you had additives that
7 went into the Shower to Shower?

8 A. Yeah. Sodium -- baking
9 soda, it could have well been baking
10 soda. Baking soda was one of the
11 additives in Shower to Shower.

12 Q. So they found traces of
13 chrysotile in one of the additives that
14 were put into Shower to Shower in
15 addition to the talc?

16 A. Well, I'm not sure that's
17 clear from this report.

18 Q. Well, it says, "We have
19 however found traces of chrysotile in
20 G-11, one of the additives to Shower to
21 Shower." Right?

22 A. Well, that's what they
23 wrote. They looked at something called
24 G-11.

1 (Document marked for
2 identification as Exhibit
3 J&J-34.)

4 MR. PLACITELLA: Now, give
5 me 36.

6 (Document marked for
7 identification as Exhibit
8 J&J-36.)

9 BY MR. PLACITELLA:

10 Q. 36 is another report
11 authored by McCrone. This is dated
12 October 27, 1972.

13 Do you see that?

14 A. It is, yes.

15 Q. And we went through this
16 last time, right? This is the one that's
17 stamped --

18 A. This is the preliminary
19 report stamped.

20 Q. "Do not use this report"?

21 A. Replaced by another version.

22 Q. Right. We'll do some of
23 this tomorrow. But what happens is J&J
24 didn't like the way this report was

1 written, right?

2 MR. BICKS: Objection to the
3 form.

4 THE WITNESS: No. I have no
5 evidence that J&J commented on
6 this report.

7 The second report, the one
8 that was used was issued by
9 McCrone based on their review and
10 evaluation a second time of the
11 talc sample.

12 BY MR. PLACITELLA:

13 Q. And what this report was,
14 was looking at the samples of Baby Powder
15 that Dr. Lewin looked at, that we talked
16 about before, for the FDA, correct?

17 A. This was -- yes, 108T and
18 109T. Yes.

19 Q. Right. And what McCrone
20 found was tremolite in those samples,
21 correct?

22 A. Yes. It says, "A few
23 tremolite rods were observed in both
24 samples, but at a level of less than

1 .05 percent. No chrysotile detected."

2 Q. Well, actually it says --
3 okay, 0.5 percent.

4 A. Yeah.

5 Q. So they found tremolite in
6 the samples that Lewin looked at?

7 A. Tremolite rods, yes.

8 MR. PLACITELLA: Okay.

9 Let's just go up to -- so we don't
10 get ahead of ourselves.

11 We're going to get a faster
12 way to do this tomorrow. They
13 promised. Hopefully they won't
14 keep doing it.

15 BY MR. PLACITELLA:

16 Q. The last two entries for J&J
17 257, we have a report by McCrone. They
18 looked at --

19 MR. PLACITELLA: Oh, we
20 didn't really go over Grantham.
21 So take out Grantham.

22 And take that out.

23 BY MR. PLACITELLA:

24 Q. Okay. And what they found

1 here was?

2 MR. PLACITELLA: And take
3 out all the references to
4 Grantham, because we didn't go
5 over that.

6 BY MR. PLACITELLA:

7 Q. That's a mine, you've told
8 me, by the way, that you believe never
9 actually went into operation?

10 A. Yeah. It was one that was
11 being evaluated as a possible, but it
12 never got anywhere.

13 Q. Okay.

14 A. Yeah.

15 Q. So does the entry now in
16 what the test revealed in those quotes,
17 is that consistent with what you saw
18 before?

19 MR. BICKS: Objection to the
20 form.

21 BY MR. PLACITELLA:

22 Q. "Fiber of chrysotile were
23 very clear, medicated powder. We found
24 one fiber of chrysotile, Shower to

1 Shower. We feel strongly it may be
2 chrysotile. Chrysotile is very low."

3 Is that fair?

4 MR. BICKS: Objection to
5 form.

6 THE WITNESS: Yeah. May be.
7 It's important to state that they
8 were not definitive.

9 BY MR. PLACITELLA:

10 Q. Well, I put an exact --
11 exact quote?

12 A. Yes. May. Yes.

13 Q. Then the next entry, also by
14 McCrone, Shower to Shower, traces of
15 chrysotile in one of the additives.

16 Is that fair?

17 A. That's what they claim to
18 have seen.

19 Q. Okay.

20 A. Yes.

21 Q. And then in --

22 A. Again, not confirmed.

23 Q. And in J&J 36, both samples
24 contained an insignificant amount of

1 tremolite.

2 Is that fair?

3 A. They described it as a few
4 tremolite rods were observed. Is that --
5 is that the last one?

6 Q. Well, actually it says,
7 "Both samples contain an insignificant
8 amount of tremolite, less than
9 .5 percent."

10 A. Okay. I was reading from
11 the conclusion, which said, "A few
12 tremolite rods were observed, less
13 than .5 percent."

14 Q. Okay. So we're okay with
15 that one?

16 A. They use the word "rods,"
17 because that's important, tremolite rods.

18 MR. PLACITELLA: Okay. Add
19 to the -- semicolon, tremolite
20 rods.

21 Now give me 57.

22 (Document marked for
23 identification as Exhibit
24 J&J-57.)

1 BY MR. PLACITELLA:

2 Q. 57 is a confidential memo
3 called "New agent systems plant trial"
4 Windsor Minerals with G. Lee being on the
5 front. We've seen this before, correct?

6 A. We have, yes.

7 MR. BICKS: Do you have
8 another copy of it?

9 MR. PLACITELLA: I don't.
10 But I'll come back to it if you
11 need time. My problem is I came
12 in with three boxes. I came to
13 New York. I carried all I could.
14 It was this high. I couldn't do
15 anymore.

16 So I -- anything that was
17 more than 30 pages, I had to make
18 a choice. But I'll put it up.

19 BY MR. PLACITELLA:

20 Q. So in this document. Why
21 don't you just describe for the record
22 what this document is briefly.

23 A. All right. We said earlier
24 that part of a processing of talc is to

1 get it clean with large plate sizes. So
2 you get the nice white lubricious silky
3 feel. So beneficiation is a process
4 that's used to wash the talc. And a
5 wetting agent, like a dish wash liquid
6 type material is added so the talc floats
7 atop of the vessel, the bath. And it
8 sticks to the bubbles. You then scrape
9 the bubbles off and wash them.

10 Do that about 30, 36 times.
11 And you get a pure clean talc. And the
12 small bits of stuff, anything that's
13 small or particles that you don't want,
14 the small plates fall to the bottom and
15 can be discarded. So what this is
16 looking at are alternative washing
17 systems to cleanup the talc, to wash it.

18 Q. Can you go to Page 5 of the
19 document where it talks about the
20 asbestiform analysis done by Walter
21 McCrone?

22 A. Yes.

23 Q. Here, it indicates that
24 Walter McCrone did an analysis as part of

1 this process and used TEM and electron
2 diffraction, correct?

3 A. Yes.

4 Q. All right. And they found
5 very low levels of chrysotile, correct?

6 A. Where are we reading?

7 Q. Right in that paragraph,
8 where it says, "Asbestiform analysis were
9 performed."

10 A. Yes. It says results are
11 questionable due to extremely low levels
12 present.

13 Q. Okay. It says they found
14 extremely low levels of chrysotile,
15 correct?

16 A. Yes. But part of this study
17 was that they deliberately added 3
18 percent chrysotile to see if they could
19 find it. That's -- we see that near the
20 end of the summary table on Bates 355.

21 Q. Well, I'll get to that.

22 And what they say is that,
23 the reason they are doing this is they're
24 trying to get the chrysotile out of --

1 make sure they don't have any chrysotile
2 in the product because of the health
3 hazard associated with chrysotile,
4 correct?

5 A. Well, it was one of the side
6 benefits that you could look at mines,
7 certainly industrial mines that may
8 contain chrysotile. If there was a way
9 of removing chrysotile, this was an
10 experiment to see if that could be done.

11 It doesn't say it was in the
12 Baby Powder product. The company
13 certainly at that time were looking at --
14 and we mentioned the Grantham mine
15 earlier -- at alternative mine sources
16 that may have contained chrysotile. And
17 if you can find a way of removing it,
18 this experiment was just one of many
19 experiments that were done to -- to look
20 at, as they described, depression of
21 chrysotile asbestos.

22 Q. And what they say is, "The
23 use of systems" -- "these system, which
24 is" -- "is strongly urged by this writer

1 to provide the protection against of what
2 are currently considered to be materials
3 presenting a severe health hazard and are
4 potentially present in all talc ores in
5 use at this time," correct?

6 A. He uses the word
7 "potentially present." It doesn't say it
8 is present. The whole point of using --
9 of getting talc mines -- that's suitable
10 for cosmetic talc, is to avoid those
11 areas of mineralogy that you don't want,
12 including asbestos, but he's using the
13 word potentially present.

14 Q. Okay.

15 A. And as I said, I think that
16 this is in the context of the company
17 looking at that time for alternative
18 mines that would possibly be available,
19 either as industrial talcs or cosmetic
20 talcs.

21 Q. What was my question?

22 A. I think you asked me what he
23 said. And I said, yes, I agree with what
24 is written.

1 Q. Okay. So you agree that
2 what he says is they're running the tests
3 because of severe potential health
4 hazards, right?

5 A. That's what he wrote. There
6 is a potential --

7 Q. He didn't write any of that
8 other stuff that you spent the last
9 35 seconds talking about?

10 MR. LOCKE: Objection.

11 MR. BICKS: All right.

12 Objection. Argumentive.

13 BY MR. PLACITELLA:

14 Q. Okay. Now --

15 A. I was setting in context.
16 But that's what he wrote, "potentially
17 present."

18 Q. And then he has a Table 15,
19 correct?

20 A. Yes. Here it is.

21 Q. All right. Table 15 says,
22 "Asbestiform fiber counts by Walter C.
23 McCrone Associates." And on the second
24 one it says 66-U product. And it says

1 "probably chrysotile," correct?

2 A. Yes, this is a result of --

3 Q. Sir, I'm just asking you --

4 A. Yes, that's what -- that's
5 what's written --

6 Q. -- if I'm -- if that's
7 what's written.

8 A. -- on this Table 15. It
9 does say that, yes.

10 Q. All right. And then when it
11 goes down to 66-A product, there is a
12 zero. So on that one they didn't find
13 any chrysotile, correct?

14 A. They didn't, no.

15 Q. And when they looked at the
16 66-U ore they didn't find any chrysotile,
17 correct?

18 A. Correct.

19 Q. All right. When they looked
20 at the 66-AC ore, they found chrysotile
21 in the ore, correct? Not probably. They
22 found chrysotile.

23 A. Well, it had been added. So
24 they did find it, yes.

1 Q. Did they add it in the 66-U
2 ore because that came up zero?

3 A. Well, that's because the
4 washing process had obviously been quite
5 successful in removing it.

6 Q. Okay. Sir, it doesn't say
7 anything here about adding, right? It
8 just gives the fiber counts in a table,
9 correct?

10 A. Table --

11 Q. Let me just go back through
12 this again. Okay. Table 15.
13 "Asbestiform fiber counts by Walter
14 McCrone." In the 66-U product, that's
15 the end product, they found probably
16 chrysotile, correct? That's what it
17 states.

18 A. After they washed it, they
19 found one.

20 Q. It doesn't say that, sir.
21 It says probably chrysotile, correct?

22 A. It says probably chrysotile,
23 yes.

24 Q. Right. And in the ore under

1 66-AC, it says they found chrysotile,
2 correct?

3 A. Yes.

4 Q. And then on the same product
5 that was made from that ore, they found
6 chrysotile, correct?

7 A. Yes. Again, this is
8 measuring, per the legend below, after
9 washing, yes. They found it after
10 washing.

11 Q. Sir, there's nothing on here
12 that says after washing, correct?

13 A. But legends, the word
14 "legend" below.

15 Q. It shows washing? Show me.
16 I blew it up.

17 A. You need to read the whole
18 presentation. They used ultrawet DS in
19 category U. They used N-butanol to wash
20 category A. And AC, they used butanol
21 and citric acid.

22 Q. Right. What they did is
23 they used a process to try to take the
24 chrysotile out, and they were somewhat

1 successful. So for example in the ore
2 they found a lot of chrysotile in the AC
3 ore, and after they put it through the
4 process, they found less chrysotile.
5 Right? That's what it says.

6 A. No, they deliberately added
7 it. Table 13 explains that they had put
8 in that certain level of chrysotile.

9 Q. So they put the exact same
10 level in?

11 A. Yeah. 3 percent, 3 percent,
12 3 percent in the ore. And between 1 --
13 between .1 and .2 percent in the product,
14 the ground ore.

15 Q. I don't see it, sir, but
16 we'll let an expert figure it out. Let's
17 just talk about what's reported. Why are
18 you smiling at me?

19 MR. BICKS: Dr. Egilman is
20 smiling at me.

21 MR. PLACITELLA: You two
22 smile at each other. Date.

23 Whatever you want. Let me finish
24 what I'm doing.

1 MR. BICKS: When you say an
2 expert will figure it out. You're
3 showing portions of it. And he's
4 showing you pretty clear portions
5 demonstrate that the questions are
6 misleading to put it mildly.

7 MR. PLACITELLA: That's not
8 nice. That's not nice.

9 MR. BICKS: It's true.

10 MR. PLACITELLA: That's
11 really not nice.

12 BY MR. PLACITELLA:

13 Q. Haven't you previously
14 testified, sir, that chrysotile asbestos
15 was found in association with the
16 Hammondsville ore body?

17 A. Have I previously testified
18 that it was?

19 Q. Yes.

20 A. I'm not aware that
21 chrysotile is in the Hammondsville ore
22 that's used in Baby Powder, the actual
23 talc that's used in Baby Powder.

24 Q. We'll do that tomorrow. The

1 Frostbite mine, was that ever used for
2 Baby Powder?

3 A. I believe that was an
4 industrial mine. I don't believe that
5 was ever used in Baby Powder. There were
6 several industrial mines that are some
7 distance away.

8 Q. Did that have asbestos in
9 it?

10 A. I don't know.

11 Q. The Frostbite mine?

12 A. I'm not familiar with it. I
13 know the name Frostbite. There were
14 several mines that we used from Windsor
15 Minerals for industrial purposes.

16 MR. PLACITELLA: Give me 63.
17 Give me 65.

18 (Document marked for
19 identification as Exhibit
20 J&J-65.)

21 BY MR. PLACITELLA:

22 Q. 65 is a report from Walter
23 McCrone concerning talc samples from the
24 Argonaut ore body. You've seen this

1 before, correct?

2 A. Yes, I think I've seen this
3 before.

4 Q. Okay. And on the next -- on
5 the first full page. It talks about the
6 examination of 38 core samples, correct?

7 A. Yes.

8 Q. Okay. And this is what
9 we've got, we went through before,
10 correct?

11 A. Yes. Core sampling is what
12 you do when you open a new mining area.

13 Q. Right. And if you go to
14 Page 4 it states what McCrone found in
15 the Argonaut ore body was chrysotile
16 asbestos and fibrous tremolite, correct?

17 A. Yeah. Two of the core --
18 two of the core samples, which they
19 reference the numbers, they showed
20 chrysotile asbestos. So they know where
21 the chrysotile would be.

22 Q. And fibrous tremolite?

23 A. And fibrous tremolite. And
24 again that would indicate where you would

1 not go and do any mining.

2 Q. And do you have any
3 contemporaneous proof, sir, that Windsor
4 Minerals specifically never went to those
5 areas that were set forth here and did
6 any work whatsoever?

7 MR. LOCKE: Objection.

8 MR. SILVER: Objection.

9 THE WITNESS: The
10 specification requires absence of
11 asbestos. So it doesn't require a
12 rocket scientist to say that why
13 go where you think there may be
14 asbestos when you have plenty of
15 areas to go that you know is no
16 asbestos.

17 BY MR. PLACITELLA:

18 Q. Well, let me ask the
19 question a different way, sir. You don't
20 have any contemporaneous evidence or
21 documents to indicate that Johnson &
22 Johnson or Windsor Minerals was
23 specifically avoiding this area of the
24 mine, correct?

1 A. To achieve the
2 specification, you would have to avoid
3 it. One is a follow-on from the other.
4 But do I have documentation to say, oh,
5 we didn't go where we drilled core sample
6 2-R-72 and 54368? No, I don't have that.
7 But to achieve a specification, you would
8 avoid those areas.

9 Q. Okay. So can you go to
10 Table 2. Table 2 is the analysis that
11 was done of the core samples by McCrone,
12 correct?

13 A. Yes. That's the -- that's
14 the analysis by electron microscopic
15 analyses of core samples.

16 Q. That was in accordance with
17 your specification, correct?

18 A. Yes.

19 Q. Okay. And McCrone found, by
20 my count, chrysotile asbestos 15 times
21 out of 38?

22 A. Well, what you're measuring
23 is the depth, as you go down the drill.
24 If you look at the second one down

1 2-R-72, they go from 131 feet down to
2 167 feet. And they find chrysotile all
3 the way down to 268 feet. So that's
4 really one core sample. That was an area
5 that they would avoid. So it's not 15.
6 It's one, two, three, four, five six, on
7 those six core samples.

8 Q. Let's just go a little bit
9 on that. And I don't want to spend a lot
10 of time on it because we have a lot to
11 do.

12 So for example, they found
13 chrysotile asbestos from 131 feet all the
14 way down to 268 feet in the 2-R-72 drill,
15 correct?

16 A. Yes. That drill is an area
17 where they hit chrysotile.

18 Q. Right. And then not far
19 away they found chrysotile in four of the
20 five samples they looked at from 92 feet
21 to 184 feet?

22 A. Well, when you say not far
23 away, I don't think that's evident from
24 this. But on a different sample rated,

1 which one are you looking at? 9-R-72?

2 They found three out of four as they
3 drilled down.

4 Q. No, four out of five.

5 A. So which one are you on?
6 Which core sample?

7 Q. A little technology glitch.
8 But we will be back. In this analysis of
9 the Argonaut mine, there's no question
10 that McCrone found chrysotile asbestos in
11 the Argonaut mine multiple times,
12 correct, and at multiple levels?

13 MR. BICKS: Objection to the
14 form.

15 THE WITNESS: You've used
16 the word "mine," Argonaut mine.

17 The Argonaut deposit, which
18 covered quite some considerable
19 acreage, had areas where there was
20 asbestos found, chrysotile found.
21 Equally there are areas where
22 there was no evidence whatsoever
23 of chrysotile.

24 So that's the mining area

1 where there's -- you go to that
2 area and avoid the area where you
3 found chrysotile. That's the
4 whole point of doing core
5 sampling.

6 BY MR. PLACITELLA:

7 Q. Okay. So it would be a lie
8 if someone ever said under oath that
9 there was never any asbestos in any
10 Vermont mine, correct?

11 MR. SILVER: Objection.

12 THE WITNESS: It depends on
13 how you're defining mine. As I've
14 said before, if you're mining from
15 an area where there's no asbestos,
16 then it is not a lie.

17 It would be incorrect though
18 to actually say well, we went into
19 an area where we knew there was
20 asbestos and started mining that.
21 But that's not the mine.

22 The core is where you drill
23 down with a diamond drill and see
24 what you find. You are not mining

1 that. You're drilling down to see
2 where you don't mine.

3 BY MR. PLACITELLA:

4 Q. Okay. We'll get to that
5 tomorrow.

6 MR. PLACITELLA: Give me 74.

7 (Document marked for
8 identification as Exhibit
9 J&J-74.)

10 BY MR. PLACITELLA:

11 Q. October 10, 1974, this is a
12 report provided by Walter McCrone to
13 Windsor Minerals, correct?

14 A. It is, yes.

15 Q. And they found chrysotile
16 fibers in one of the samples?

17 A. Well, the samples were sent
18 by Windsor Minerals, yes.

19 Q. And -- okay.

20 MR. PLACITELLA: Give me 89.

21 (Document marked for
22 identification as Exhibit
23 J&J-89.)

24 MR. PLACITELLA: This is 90.

1 BY MR. PLACITELLA:

2 Q. 89 is another report from
3 McCrone to Windsor Minerals.

4 A. Yes. We've seen this
5 before. Yes.

6 Q. And this is a report of an
7 electron microscopy that was done from
8 the Windsor mineral ore body, correct?

9 A. It was done from -- let's
10 read this very carefully. Because from
11 my recollection some of these relate to
12 industrial talc from the industrial mines
13 owned by Windsor Minerals.

14 Q. What it says is "from your
15 ore body," correct? It's the Windsor
16 mineral ore body?

17 A. Yeah, it doesn't describe it
18 here, but there are ore bodies owned by
19 Windsor Minerals, which are used for
20 industrial talcs, Clifton mine and
21 several others, were industrial mines.

22 Q. In Vermont?

23 A. The Clifton mine is in
24 Vermont, yes, industrial mine.

1 Q. And the industrial mines had
2 asbestos in them?

3 A. Well, I don't know. What
4 I'm saying is, if you are talking here
5 about Baby Powder, what I'm saying is
6 there's no evidence that these related to
7 Baby Powder.

8 Q. I didn't ask you those
9 questions yet. All right. Let me ask
10 you the questions, and you can respond,
11 okay. It says they kept a running
12 tabulation of the asbestos which they
13 could find, correct?

14 A. Yes, it does say that.

15 Q. Okay. And it was from the
16 Windsor mineral talc, correct?

17 A. It was from talc supplied by
18 Windsor Minerals.

19 Q. And in Table 1 they actually
20 list the confirmed -- where they found
21 and confirmed asbestos, correct?

22 A. They report those particular
23 batches that were claimed to contain
24 asbestos, yes.

1 Q. Right. What is sediment, by
2 the way, when testing is done? What
3 do -- what do they mean when they say
4 sediment?

5 A. Where are you --

6 Q. Table 2, sample content of
7 the sediment.

8 A. I don't know. I mean, the
9 cover letter says, "Some of the samples
10 showed extreme amounts of sedimentation
11 at the bottom of the test tube when we
12 prepared these samples."

13 Q. In Table 2 they show all the
14 places they found fibers and where they
15 confirmed asbestos, correct?

16 A. They list headings of
17 asbestos and fibers and organics. That's
18 the stuff when you are drilling down with
19 a core, you go through tree roots and all
20 sorts of rubbish.

21 Q. And more than half of the
22 samples they looked at they found fibers,
23 correct, in the sediment?

24 A. Yes. I mean, the very fact

1 that they contain organics screams out to
2 me that these were quite possibly core
3 samples. But it doesn't say that. But
4 organic material consisted of bacteria,
5 amorphous structures, which seemed to be
6 organic in nature, general crud which you
7 find in some of the samples.

8 So what they're looking at
9 here implies that it's not talc that's
10 used in baby products.

11 Q. It doesn't say that
12 anywhere, does it, sir?

13 A. No, it says it contains
14 large amounts of organic matter, which is
15 the kind of thing that you get when you
16 do a core drilling sample. You go
17 through soil, tree roots, all sorts of
18 rubbish.

19 Q. It doesn't say anything
20 about it's not used in Baby Powder.
21 That's just your editorializing.

22 A. It does not say.

23 Q. Okay.

24 A. It does not say we're -- the

1 company is putting tree roots in Baby
2 Powder, no.

3 Q. So there's nothing in here
4 that says it's not used in Baby Powder,
5 correct?

6 A. There's nothing that says
7 that it was not used. No.

8 MR. PLACITELLA: Okay. Can
9 we go back to the chart to make
10 sure we're staying current.

11 BY MR. PLACITELLA:

12 Q. 24, McCrone. Where are we?

13 MR. PLACITELLA: Where are
14 we? 57.

15 BY MR. PLACITELLA:

16 Q. 57 was the Dartmouth study.
17 Chrysotile fibrous suppression as
18 indicated. We didn't go over arsenic.
19 So take arsenic out. You'll recall
20 Dartmouth found amphiboles at 100 to
21 200 parts per million in the ore and
22 3,000 in the ore. Do you recall that?

23 And McCrone found chrysotile
24 in the ore in the finished product. Do

1 you remember that?

2 MR. BICKS: Objection to the
3 form.

4 THE WITNESS: Yeah. What
5 you read, Table 13 says that there
6 were 3,000 PPM, parts per million,
7 of amphibole in the ore in A, B
8 and C.

9 And what I'm saying is that
10 from my knowledge of people I've
11 spoken with, this is the -- this
12 is the process that's done to
13 actually -- you add it
14 deliberately and then see if you
15 can find it.

16 BY MR. PLACITELLA:

17 Q. Sir, I'm just asking what's
18 reported. I'm not asking for your
19 opinions. I'm just asking what is
20 reported.

21 A. It was --

22 Q. Do you remember that was the
23 instruction when we started? What was
24 reported.

1 MR. LOCKE: Objection.

2 THE WITNESS: Yes, and it is
3 reported that the ore contained --
4 when they were doing the study
5 3,000 parts per million for ore A,
6 ore B, and ore C.

7 BY MR. PLACITELLA:

8 Q. Then the next exhibit, 65
9 was a McCrone report. And that's where
10 the TEM found chrysotile fibers and
11 tremolite, correct?

12 MR. BICKS: Objection to the
13 form.

14 THE WITNESS: Which exhibit
15 number?

16 BY MR. PLACITELLA:

17 Q. 65.

18 A. Let's read this again. Yes,
19 these are diamond core drillings to see
20 where the talc was and where you'd avoid
21 it.

22 Q. Okay.

23 A. So they did find areas that
24 they would avoid trace of chrysotile.

1 Q. And fibrous tremolite?

2 A. Well --

3 Q. 74. This is another McCrone
4 report, it was of a product. They found
5 fibrous asbestiform material chrysotile
6 fibers, correct?

7 A. Yeah. These were samples.
8 Again, it doesn't specify whether they
9 were diamond core drill samples. But in
10 amongst those, they claim to have found
11 asbestiform fibers.

12 Q. Next 89, what we just went
13 through, confirmed asbestos low to
14 medium, correct?

15 A. Again, along with tree roots
16 and what they describe as crud, which --

17 Q. I'm not asking about whether
18 they found tree roots. I'm asking you
19 whether they found asbestos. They found
20 asbestos in that testing, correct?

21 A. In that testing, yes.

22 MR. PLACITELLA: Okay. Now,
23 give me 169, please.

24 BY MR. PLACITELLA:

1 Q. I'm sorry. Did we talk
2 about the Rainbow mine? That was used in
3 Baby Powder, correct?

4 A. It was used for a short
5 period of time, yes.

6 (Document marked for
7 identification as Exhibit
8 J&J-169.)

9 BY MR. PLACITELLA:

10 Q. And this is a November 6,
11 1980 report. This is a report from
12 McCrone, again to Windsor Minerals,
13 correct?

14 A. Yes.

15 Q. And here they found
16 chrysotile asbestos in a sample. And
17 they said it's probably not a
18 contaminant, correct?

19 A. They describe the talc
20 samples labeled W. Gregg XR. I don't
21 know which mine that is from.

22 In that letter, the author
23 states that he found chrysotile asbestos
24 in the sample. Yeah. But what W. Gregg

1 XR sample is, I don't know.

2 MR. PLACITELLA: Give me
3 179, please.

4 (Document marked for
5 identification as Exhibit
6 J&J-179.)

7 MR. PLACITELLA: This is
8 180. Sorry. There's only one
9 copy. I apologize.

10 BY MR. PLACITELLA:

11 Q. 179 is from 1984 from
12 McCrone to Roger Miller, correct?

13 A. We have two.

14 Yes.

15 Q. And what they did here is
16 they actually went and then looked at air
17 samples, correct?

18 A. Yes. Roger Miller submitted
19 four air filter samples.

20 Q. Right.

21 A. And they reported the --

22 Q. Air filter means --

23 A. It's a personal --

24 Q. -- what's in the air where

1 people are doing the work in the mine,
2 right?

3 A. Yes. It's a filter that you
4 wear when you're working.

5 Q. And they found in all four
6 of these samples, chrysotile asbestos
7 fibers, correct?

8 A. They report that, although
9 it doesn't say which mine or which source
10 it was. They report that they found
11 fibers on the filters.

12 Q. Well, what mine was Windsor
13 Minerals using in 1984? I thought we
14 went over them all. Do you know which
15 one it was? Well, your testimony will
16 speak for itself. We don't have to do
17 that?

18 A. No, I don't know which one
19 it was. But the company owned industrial
20 mines as well as cosmetic mines. So what
21 I said is I don't know which mine this
22 relates to.

23 Q. Okay. But for example here
24 it says they found chrysotile fibers

1 6x10⁴. That's what 6,000 fibers.

2 A. Yes.

3 Q. 6,000 fibers?

4 A. On a filter.

5 Q. On the filter. On one
6 single filter, they found 6,000 fibers of
7 chrysotile asbestos, correct?

8 A. Well, that's what's written
9 in this memo, yes.

10 Q. Okay.

11 A. But like I say, which mine
12 this was, we have no idea. The company
13 owned mines in California as well as
14 Vermont.

15 Q. So you think this is from a
16 California mine?

17 A. I have no idea. I'm
18 certainly not going to speculate.

19 Q. How would we find out where
20 this came from?

21 A. I don't know.

22 Q. I mean, these are documents
23 that you gave us responsive to our
24 discovery request.

1 A. Yeah.

2 Q. So if they didn't pertain to
3 the Johnson's Baby Powder, what did you
4 give them to us for?

5 MR. BICKS: Argumentive.

6 MR. SILVER: Objection.

7 BY MR. PLACITELLA:

8 Q. Well, I didn't ask you for
9 documents that didn't pertain to Baby
10 Powder or Shower to Shower. Reportedly
11 you only gave us the documents that
12 related to Johnson's Baby Powder, right?

13 A. Again --

14 MR. BICKS: Objection.

15 Argumentative.

16 BY MR. PLACITELLA:

17 Q. I mean, you didn't give me
18 Japan documents, Australia documents,
19 Brazil documents. You gave me Windsor
20 Mineral documents?

21 A. That's correct. Windsor
22 Minerals documents related to the United
23 States.

24 Q. Okay. Now, do you know

1 where the codes are that go with this?

2 A. There are no codes.

3 Q. I'm looking down here?

4 A. Sample 28911.

5 Q. I'm looking down here

6 Reference 4055.

7 Do you see that down at the
8 bottom?

9 A. I don't know -- I have no
10 idea what that means, Reference 4055.

11 Q. That's the general file with
12 all the test results for the Vermont
13 mines, right?

14 A. I have no idea.

15 Q. You don't know?

16 A. No, I don't know that.

17 Q. Okay. Can we figure that
18 out maybe overnight?

19 Okay. So --

20 MR. PLACITELLA: Give me
21 182. Oh, great.

22 Give me 228.

23 (Document marked for
24 identification as Exhibit

1 J&J-228.)

2 BY MR. PLACITELLA:

3 Q. You've seen 228 before.

4 This is a report from 2004 concerning the
5 testing of Johnson's Baby Powder.

6 A. Is this the -- is this the
7 TV station?

8 Q. Yeah, the TV station got
9 ahold of your Baby Powder and hired an
10 independent laboratory that did a test.
11 You know what this is, right?

12 A. Yes. I recollect this, yes.

13 Q. The company they hired was
14 called Maywood Laboratories, correct?

15 A. Yes, it was.

16 Q. And Maywood Laboratories
17 used TEM and looked at your Baby Powder,
18 correct?

19 A. They -- yes. TEM, yes.
20 They did use TEM.

21 Q. And they found asbestos,
22 correct?

23 A. Well, they claimed to have
24 done, although that was never confirmed

1 when it was evaluated elsewhere.

2 Q. All I'm saying is, reported
3 to you in this point in time was an
4 independent laboratory, looked at your
5 Baby Powder, and found asbestos, correct?

6 A. They claim to have found
7 asbestos.

8 Q. Well, they wrote it down in
9 a report from a certified laboratory, and
10 you got a copy, correct?

11 MR. BICKS: Objection to the
12 form.

13 THE WITNESS: Well, there's
14 a copy. And this is it. Yes.

15 BY MR. PLACITELLA:

16 Q. Okay. Give me 255.

17 (Document marked for
18 identification as Exhibit
19 Hopkins-255.)

20 BY MR. PLACITELLA:

21 Q. By the way, did you -- you
22 testified in the Herford trial that
23 asbestiform minerals were found in
24 Johnson Baby Powder by Bowling Green

1 University.

2 Do you recall that?

3 A. That's documentation which
4 was presented on the Elmo. I've
5 certainly seen that report from Bowling
6 Green. They were two students, two
7 summer holiday students who were doing a
8 project. So yes, we have seen that.

9 Q. All I know is -- and that
10 was reported to Johnson & Johnson,
11 correct?

12 A. It was indeed, yes.

13 Q. Okay. Now, 255 is a memo
14 from Mr. Ashton to Dr. Hildick-Smith.
15 Who is Dr. Smith?

16 A. He was an M.D. qualified --
17 he was head of a medical department back
18 in the early '70s, Gavin Hildick-Smith.
19 Yes, I have met him.

20 Q. Okay. And you've seen this
21 memo before, right?

22 A. I have seen it.

23 Q. This is about testing that
24 was done of a production batch for

1 Johnson's Baby Powder, correct?

2 A. This is a bit more of the
3 Mount Sinai Dr. Langer story.

4 Q. Right. And what --
5 Mr. Ashton says that if -- in his
6 opinion, that if the Baby Powder is
7 tested, it's going to show needle-like
8 fibers of tremolite, correct?

9 MR. BICKS: Objection to
10 form.

11 THE WITNESS: Well, what he
12 says is that we considered free
13 non-talc needles for the trace.
14 And he goes on to say, "If such an
15 assay were to be run by
16 microscopists" -- I cannot read
17 the word, something with the --
18 maybe it's -- "aware of the
19 differences between fibrous talc
20 and broken talc plates and
21 tremolite, they would expect them
22 to report 5.5 percent needles by
23 count." Because they were
24 overestimating the needles,

1 mistaking them for broken talc.

2 BY MR. PLACITELLA:

3 Q. And what he says is that he
4 ran a test and it showed that the
5 minerals were present and that there was
6 tremolite/actinolite in the samples, in
7 the production samples, right? Dr.
8 Ashton or Mr. Ashton found it himself.
9 That's what it says?

10 MR. BICKS: Objection to the
11 form.

12 THE WITNESS: What he wrote
13 is I touched on it -- I touched --
14 I run an x-ray diffractograph on
15 the batch," whatever that batch
16 was. "It showed that the minerals
17 are present," and talc is,
18 chlorite -- mica, chlorite,
19 tremolite/actinolite and
20 magnesite. Might be some
21 carbonate.

22 BY MR. PLACITELLA:

23 Q. So Johnson & Johnson ran
24 their own tests and found tremolite and

1 actinolite in the talc used in Johnson's
2 Baby Powder, correct? That's what it
3 states?

4 MR. LOCKE: Objection to
5 form.

6 THE WITNESS: He reports
7 that he found
8 tremolite/actinolite -- dash
9 actinolite.

10 MR. PLACITELLA: Can you
11 give me 19?

12 BY MR. PLACITELLA:

13 Q. You have 19. Do you have 19
14 in front of you?

15 A. Do I?

16 Q. Yeah. You should. It's a
17 July 29, 1971 Johnson & Johnson memo. We
18 did that. We did this. We don't have to
19 do it again.

20 MR. PLACITELLA: Give me 44.

21 (Document marked for
22 identification as Exhibit
23 J&J-44.)

24 BY MR. PLACITELLA:

1 Q. 44 is an April 26, 1973,
2 memo from Petterson copied to Miller and
3 Ashton. It's sent directly to DD
4 Johnston. Who is that?

5 A. I don't know. I don't know
6 that I ever met DD Johnston.

7 Q. And you've seen this before
8 many times, correct?

9 A. Bear with me. Yes.

10 Q. And it starts out by saying,
11 "It is our joint conclusion that we
12 should not rely on the clean mine
13 approach as a protective device for Baby
14 Powder in the current asbestos or
15 asbestiform controversy."

16 Do you see that?

17 A. Yes. That was a fair
18 comment in 1973.

19 Q. Okay. And on the next page
20 when he talks about Baby Powder, do you
21 see that?

22 A. Yes.

23 Q. And he states, when he's
24 talking about Baby Powder, that there

1 will occasionally be sub-trace quantities
2 of tremolite or actinolite that can be
3 classified as asbestos fiber, correct?

4 A. That's what he wrote in
5 1973.

6 MR. PLACITELLA: Now give me
7 185.

8 (Document marked for
9 identification as Exhibit
10 J&J-185.)

11 BY MR. PLACITELLA:

12 Q. 185 is a March 30, 1987,
13 letter to Roger Miller, correct, from
14 Johnson & Johnson?

15 A. Yes.

16 Q. Okay. And in that report
17 you detail the amphibole particles that
18 were found, correct?

19 MR. BICKS: Objection to the
20 form.

21 THE WITNESS: It says, "The
22 accompanying table reports the
23 amphibole particles per slide of
24 27 samples, submitted March 1987.

1 No fibrous forms observed."

2 BY MR. PLACITELLA:

3 Q. And below there, you
4 actually detail all of the amphiboles
5 that you find, correct?

6 A. Yes. They are broken down
7 into the different mining operational
8 areas from what is described as tails,
9 concentrates, middlings.

10 Q. All over the mine?

11 A. Well, no. This is a
12 process. They are looking at the various
13 samplings during the processing of talc.

14 Q. Okay. And if you go to
15 Bates Number 44325.

16 Do you see that?

17 A. I do, yes.

18 Q. When they refer to
19 tremolite, they refer to it as being in
20 free needle form, correct?

21 A. "Tremolite in 6 volume
22 percent is free" -- "free needles in the
23 loose grain mounts."

24 Yes, they've used that word.

1 Q. So they found 6 percent of
2 what they were looking at to be free
3 needles of tremolite, correct?

4 MR. BICKS: Objection to
5 form.

6 THE WITNESS: I'm not sure.
7 It says 6 percent. This relates
8 to --

9 BY MR. PLACITELLA:

10 Q. 6 volume percent, it says?

11 A. Yeah, but I'm not sure what
12 it is that they are measuring. When we
13 look at that, it's something on a
14 microscope slide.

15 Q. But when they are
16 characterizing the tremolite, they're
17 characterizing it as needles, correct?

18 A. They use that word back at
19 that time, yes. They used that word.

20 MR. PLACITELLA: Okay. Can
21 you give me 229, please.

22 We did this one. Yeah, we
23 did this one.

24 Give me 164.

1 (Document marked for
2 identification as Exhibit
3 J&J-164.)

4 BY MR. PLACITELLA:

5 Q. 164 is a handwritten note
6 dated February 9, 1979. Do you see that?

7 A. It is, yes.

8 Q. And it has the name Harold
9 Cohen. Do you know who he is?

10 A. I don't think I ever met
11 Mr. Cohen, no. It says baby products
12 quality control.

13 Q. And it says they did
14 analytical research and found massive
15 amphiboles in the 66 composite sample on
16 November 6th and 10th.

17 Do you see that?

18 A. Yes.

19 Q. And the sample was then
20 forwarded to George Lee's group where the
21 presence of amphiboles was confirmed, and
22 they identified those amphiboles as
23 tremolite and actinolite, correct?

24 A. That is what is written.

1 Q. And so in 1979 it was
2 reported that in the Vermont 66 talc,
3 there was tremolite and actinolite both
4 by Johnson & Johnson itself and its
5 outside consultant RJ Lee, correct?

6 MR. BICKS: Objection to the
7 form.

8 THE WITNESS: I don't see RJ
9 Lee mentioned on this.

10 BY MR. PLACITELLA:

11 Q. Or George Lee. Isn't that
12 RJ Lee?

13 A. No, no George Lee is a
14 scientist in Johnson & Johnson --

15 Q. Oh, so you have two
16 different -- I'm sorry. Then I was
17 mistaken. So two different people in
18 Johnson & Johnson found tremolite and
19 actinolite?

20 A. Well, I don't see George Lee
21 mentioned in this memo. It's a note.

22 Q. Well, it says the sample was
23 forwarded to George Lee's group?

24 A. Okay, or George --

1 Q. Where the presence --

2 A. Fine.

3 Q. -- of amphiboles was
4 confirmed, correct?

5 A. George -- George Lee was a
6 scientist in baby products company.

7 Q. Okay.

8 A. Nothing to do with RJ Lee.

9 Q. Okay, good. I'm glad you
10 cleared that up.

11 Now, give me Imerys-7.

12 MR. PLACITELLA: You don't
13 have that one.

14 How about 6? I guess we
15 have to do this tomorrow. You
16 don't have a 6. What's going on.
17 Give me 5.

18 (Document marked for
19 identification as Exhibit
20 J&J-5.)

21 MR. SILVER: The Bates
22 number, Chris?

23 MR. PLACITELLA: This is
24 something that was just produced.

1 I don't think it has a Bates
2 number.

3 MR. SILVER: There's no
4 document in the MDL that doesn't
5 have a number.

6 MR. PLACITELLA: Michelle --
7 or, I mean, Lea will tell you.
8 She --

9 MS. O'DELL: It was provided
10 through --

11 THE COURT REPORTER: I can't
12 hear you. I'm sorry.

13 (Discussion held off the
14 record.)

15 MR. SILVER: I just wanted
16 to know what the statement was if
17 wasn't produced with a Bates
18 number for some reason.

19 MS. O'DELL: Well, the point
20 was, to be clear, it was produced
21 in a native file. And the file
22 name has a Bates number and...

23 BY MR. PLACITELLA:

24 Q. This was just sent to us.

1 It's labeled TEM asbestos analysis of
2 Argonaut product composites.

3 Do you see that? Have you
4 ever seen this before?

5 A. No, this is -- this is
6 summary dated last week, August 8, 2018.

7 Q. Yeah. But do you see that
8 it refers to samples dating back to 2004
9 and 2005?

10 A. Yes. Although at that
11 point, Johnson's Baby Powder was no
12 longer being sourced from this operation.
13 It was sourced from China.

14 Q. In 2004, 2005, you were only
15 getting it from China?

16 A. From 2003 onwards.

17 Q. Well, when in 2003?

18 A. I believe the beginning of
19 2003. But I'm not sure. I think it was
20 Quarter 1.

21 Q. Okay. Well, how about in
22 2002? Were you still getting it from the
23 Argonaut mine?

24 A. Yes.

1 Q. Okay. If we go to Page 4,
2 do you see where in 2002 they found
3 chrysotile asbestos on September 2002 in
4 the float feed?

5 A. I see that. In the float
6 feed. Yes, I see it.

7 Q. And --

8 A. One structure reported, yes.

9 Q. And then in June, May, if
10 you go to the next page, April, they
11 found chrysotile asbestos in the Ludlow
12 mine, correct?

13 A. Yeah, what -- what isn't
14 clear to me is that, although it's headed
15 "Asbestos TEM Analysis of Argonaut
16 Product Composites," we've used -- the
17 author of this used the word "Ludlow."
18 And that is not the word that I've seen
19 described in the Argonaut. Ludlow is a
20 location, an area. And --

21 Q. Well --

22 A. I don't believe that's where
23 the Argonaut mine is, but --

24 Q. Well, this was provided to

1 us in discovery and it details chrysotile
2 being found, according to this, in the
3 Argonaut product composites, in 2002,
4 2003, 2004, 2005, and 2006, correct?

5 MR. LOCKE: Objection.

6 MR. SILVER: Objection to
7 form.

8 THE WITNESS: Well, it's
9 described as Ludlow. Ludlow fine,
10 Ludlow coarse. Ludlow fine,
11 Ludlow coarse. And obviously this
12 is still being used, or at least
13 was being used up until 2005.

14 And the point that I'm
15 making is my understanding of the
16 description that Johnson's powders
17 were used up until 2003 was from
18 the Argonaut mine, the Argonaut
19 pit. And this mentions Ludlow.

20 BY MR. PLACITELLA:

21 Q. So -- right. So if this
22 is --

23 A. Confused.

24 Q. If this is from composite

1 samples at the Argonaut mine, it is
2 indicative of the fact that they were
3 finding chrysotile from product that was
4 being generated from the Argonaut mine,
5 correct?

6 MR. SILVER: Objection to
7 form.

8 MR. BICKS: Objection to
9 form. You are speculating.

10 THE WITNESS: No, we're
11 speculating. I mean, what is
12 interesting, if you look at Page 5
13 of six, the very last item, it
14 does actually specify the grade
15 that was used in Baby Powder, as
16 opposed to something that wasn't.

17 Grade 66 is specified.
18 There wasn't mention -- there's no
19 mention of chrysotile.

20 So, you know, that's the
21 point that I'm making, is that
22 this -- this is not clear that
23 this ever was Johnson's Baby
24 Powder.

1 BY MR. PLACITELLA:

2 Q. I guess we have to take
3 the -- when it says "float," by the way,
4 that's what goes into Johnson's Baby
5 Powder, correct?

6 MR. SILVER: Objection to
7 form.

8 THE WITNESS: The float feed
9 goes into the flotation process
10 which is the washing process. And
11 the process that cleans up the
12 talc, washes the particles, and
13 dries them.

14 BY MR. PLACITELLA:

15 Q. Right. And the float feed
16 is what ends up in the product, correct?

17 MR. SILVER: Objection to
18 form.

19 THE WITNESS: No, no, no.
20 Only some of the float feed ends
21 up in the product.

22 BY MR. PLACITELLA:

23 Q. Okay. And in the float
24 feed, they found from the Argonaut mine

1 chrysotile asbestos, correct?

2 MR. SILVER: Objection to
3 form. Misstates the document.

4 THE WITNESS: Well, again,
5 what this says, it doesn't say the
6 Argonaut mine. Each of those
7 identities relates to the Ludlow.
8 Ludlow coarse, Ludlow fine. Only
9 one of them at the bottom, Page 5,
10 it actually says Grade 66, which
11 is an identifier for the material
12 that's used in Baby Powder.

13 BY MR. PLACITELLA:

14 Q. So what period of time were
15 you using the Ludlow mine for Baby
16 Powder?

17 A. I'm not aware the Ludlow
18 mine was used. I mean, it's -- I don't
19 know what the descriptor is for Ludlow
20 mine versus Argonaut. The descriptor
21 that I've seen for talc usage up to this
22 point would be the Argonaut mine. What
23 the Ludlow fine and Ludlow coarse is, I
24 have no idea.

1 Q. Okay. So we have to ask
2 Imerys those questions. Fair?

3 A. I think that's reasonable.
4 Yes.

5 Q. Okay. Now, I know you've
6 been asked this many times, but I have to
7 create a record. You're aware that
8 Johnson & Johnson hired Alice Blount as a
9 consultant at some point in time?

10 A. She was one of many, many
11 people who have been hired, if that's the
12 right word to provide opinion advice.

13 Q. All right. And she worked
14 for Rutgers University at the time that
15 you hired her, correct?

16 A. I believe that is the case,
17 yes.

18 Q. And you're aware that
19 Dr. Blount in or about 1991 tested your
20 Baby Powder and found asbestos, correct?

21 MR. BICKS: Objection to the
22 form.

23 BY MR. PLACITELLA:

24 Q. That's what she reported?

1 A. She reported a finding. Her
2 publication did not specify that she
3 found asbestos in Johnson's Baby Powder.
4 There is a handwritten annotation stapled
5 to that report whereby a product
6 designated "I", letter I, was claimed to
7 be Johnson's Baby Powder.

8 Q. Yeah, but she told you
9 privately that it was Johnson's Baby
10 Powder that she found asbestos in,
11 correct?

12 MR. BICKS: Objection to the
13 form.

14 THE WITNESS: Again, I've
15 not seen any private
16 correspondence. What I have seen
17 is her deposition in a recent case
18 whereby it was quite apparent that
19 she was really quite confused as
20 to what she had been looking at.
21 She used the designation "I" for
22 things other than Baby Powder.

23 BY MR. PLACITELLA:

24 Q. Sir, did I ask you anything

1 about her deposition?

2 A. No, you didn't.

3 Q. What was my question?

4 A. You said that she told --
5 told the company privately.

6 Q. Right.

7 A. And what I said was I don't
8 have that information privately.

9 Q. You don't know that
10 privately, Alice Blount told the company
11 that she found asbestos in the Johnson's
12 Baby Powder?

13 MR. BICKS: Objection to the
14 form.

15 THE WITNESS: If there is a
16 document, then we can say, yes,
17 this is what she wrote. But I
18 don't have any documentation. I
19 have not seen that private
20 documentation.

21 BY MR. PLACITELLA:

22 Q. Are you sure about that?

23 A. Well, I've seen, as you've
24 said, many -- 10-, 20,000 documents. I

1 don't recollect seeing that one. But I'm
2 happy to comment if such a private --

3 Q. I'm just asking what you
4 know.

5 A. No. In that case then, I've
6 not seen a private communication from Dr.
7 Blount.

8 MR. PLACITELLA: Can you
9 give me --

10 MR. SILVER: Can I have a
11 time check, please.

12 THE VIDEOGRAPHER: We are at
13 six hours and 57 minutes.

14 MR. PLACITELLA: I've got
15 three more minutes. We'll see you
16 tomorrow.

17 THE WITNESS: You sure?

18 MR. PLACITELLA: Yes.

19 THE WITNESS: Okay.

20 MR. PLACITELLA: I've got
21 three more minutes.

22 THE WITNESS: Sleep well.

23 MR. PLACITELLA: Have a
24 drink.

1 THE VIDEOGRAPHER: Off the
2 record, right? Stand by, please.
3 The time is 6:12 p.m. Going off
4 the record.

5 (Excused.)

6 (Adjourned at approximately
7 6:12 p.m.)
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1
2 CERTIFICATE
3
4

5 I HEREBY CERTIFY that the
6 witness was duly sworn by me and that the
7 deposition is a true record of the
8 testimony given by the witness.

9 It was requested before
10 completion of the deposition that the
11 witness, JOHN HOPKINS, Ph.D., have the
12 opportunity to read and sign the
13 deposition transcript.

14
15 _____
16 MICHELLE L. GRAY,
17 A Registered Professional
18 Reporter, Certified Shorthand
19 Reporter, Certified Realtime
20 Reporter and Notary Public
21 Dated: August 20, 2018
22
23
24

25 (The foregoing certification
26 of this transcript does not apply to any
27 reproduction of the same by any means,
28 unless under the direct control and/or
29 supervision of the certifying reporter.)
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INSTRUCTIONS TO WITNESS

Please read your deposition over carefully and make any necessary corrections. You should state the reason in the appropriate space on the errata sheet for any corrections that are made.

After doing so, please sign the errata sheet and date it.

You are signing same subject to the changes you have noted on the errata sheet, which will be attached to your deposition.

It is imperative that you return the original errata sheet to the deposing attorney within thirty (30) days of receipt of the deposition transcript by you. If you fail to do so, the deposition transcript may be deemed to be accurate and may be used in court.

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	E R R A T A					
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ACKNOWLEDGMENT OF DEPONENT

I, _____, do
hereby certify that I have read the
foregoing pages, 1 - 434, and that the
same is a correct transcription of the
answers given by me to the questions
therein propounded, except for the
corrections or changes in form or
substance, if any, noted in the attached
Errata Sheet.

JOHN HOPKINS, Ph.D.

DATE

Subscribed and sworn
to before me this

_____ day of _____, 20____.

My commission expires: _____

Notary Public

1	LAWYER'S NOTES		
2	PAGE	LINE	
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Exhibit 36

Battelle Memorial Institute

S O S K I N G A V E N U E C O L U M B U S I, O H I O

April 12, 1960

Mr. H. L. Warner
Office of General Counsel
Johnson and Johnson
New Brunswick, New Jersey

Dear Mr. Warner:

This letter report covers the flotation studies made in our laboratory in connection with the preparation of the patent application "Platy Talc Beneficiation".

All of the experiments discussed in this report were made using Italian No. 2 talc. The first five experiments were made to determine whether anionic surface active agents other than the Aerosols, 18 or OT, were effective in selective flotation of platy talc. Four anionic reagents were selected for the study. These are listed in Table 1.

TABLE 1. ANIONIC REAGENTS STUDIED

Trade Name	Class or Formula	Main Uses
Duponal ME	Sodium lauryl sulfate	Detergent, dispersant, emulsifying agent
Anatron L215	Alkyl amide sulfonate	Detergent
Tergitol P28	Sodium di (2-ethyl hexyl) phosphate	Wetting agent, emulsifying agent
Igepon T	A substituted amide $C_{17}H_{33}CON(CH_3)C_2H_4SO_3Na$	Detergent

Based on the available flotation literature, it appears that two of the reagents, Anatron L215 and Igepon T, have the same formula. The difference between them is that they are marketed as powders at different concentrations, Anatron L215 at 16 per cent and Igepon T at 33 per cent.

The results of the experiments in the current program, as well as the results of seven previously reported experiments, are presented in Table 2.

TABLE 2. SUMMARY OF FLOTATION EXPERIMENTS WITH SURFACE ACTIVE REAGENTS

8-MAS-2667-2 Document 26640-2 Filed 03/11/15

157169

Experiment	Feed Solids, %	pH	HCl	Dowfroth 250	Flotation		Results, Float 1(a)						Per Cent Dolomite(c)
					Reagents, lb/ton of flotation feed		Weight Per Cent(b)	Mineral Count, per cent					
					Other Reagents	Platy Talc		Nonplaty Talc	Dolomite	Tremolite	Others		
163(d)	7.2	6.8	--	--		36.3	95(e)	>4(e)	trace	trace	trace	0.4	
162(d)	7.2	6.4	1.79	--		34.4	96	4	trace	trace	trace	0.2	
96(f)	8.4	7.5	1.75	--	0.07 - Dowfroth 200	64.8	98	1	--	<1	trace	0.5	
134(f)	8.0	6.7	1.77	0.07		59.0	98	1	<1	<1	trace	0.3	
187(d)	7.3	7.5	--	--	1.32 - Aerosol OT	69.7	>97	>2	trace	trace	trace	0.9	
182(d)	7.4	6.8	1.73	0.04	0.74 - Aerosol 18	70.8	<99	>1	trace	trace	trace	0.4	
189(d)	7.0	6.8	1.80	0.04	0.62 - Aerosol 18	70.4	>98	>1	trace	trace	trace	0.6	
328	8.6	7.2	1.38	0.05	0.47 - Sodium Lauryl Sulfate - Anionic	93.0	>97	2	<1	trace	trace	0.8	
329	8.7	7.0	1.37	0.05	0.058- Sodium Lauryl Sulfate - Anionic	70.8	>98	<1	trace	trace	trace	0.3	
330	8.4	7.2	1.42	0.05	0.48 - Alkyl Amide Sulfonate - Anionic	56.5	>98	<1	trace	trace	trace	0.2	
331	8.4	7.1	1.42	0.05	0.18 - Sodium di (2-ethyl hexyl) Phosphate - Anionic	69.3	>98	<1	trace	trace	trace	0.3	
332	8.7	7.2	1.37	0.05	0.46 - Substituted Amide C ₁₇ H ₃₃ CON(CH ₃)C ₂ H ₄ SO ₃ Na - Anionic	70.8	>98	1	trace	trace	trace	0.3	
334	8.8	6.9	1.35	0.04	0.46 - Trimethyl-n-dodecyl ammonium chloride - Cationic	71.0	>98	>1	trace	trace	trace	0.2	
335	8.8	7.4	1.35	0.05	0.46 - Trimethyl-n-dodecyl ammonium chloride - Cationic	75.6	98	>1	trace	trace	trace	0.3	
336	9.0	7.6	1.31	0.04	0.45 - Octylamine - Cationic	88.1	96	>3	<1	trace	trace	0.7	
337	9.0	7.5	1.32	0.04	0.11 - Octylamine - Cationic	71.2	>97	>2	<1	trace	trace	0.3	
338	8.9	7.3	1.35	0.05	0.17 - Hexadecyl Dimethyl Amine - Cationic	70.9	99	trace	trace	trace	trace	0.3	
339	8.8	6.8	1.36	0.05	0.46 - Sorbitan Monolaurate - Nonionic	77.2	99	trace	trace	trace	trace	0.3	
340	8.6	7.2	1.39	0.05	0.47 - Sorbitan Monolaurate Polyoxyethylene Derivative - Nonionic	72.8	<99	<1	trace	trace	trace	0.2	
341	8.6	6.7	1.39	0.05	0.47 - Secondary Amide of Lauric Acid - Nonionic	72.9	99	trace	trace	trace	trace	0.2	
342	9.0	7.0	1.32	0.04	0.45 - Nonyl Phenyl Polyethylene Glycol Ether - Nonionic	82.6	>98	1	<1	trace	trace	0.5	
343	9.0	6.6	1.31	0.04	0.44 - Oleic Acid Plus Sodium Oleate - Anionic Collector	78.5	<95	4	1	trace	trace	0.9	

(a) Float 1 is froth removed in five minutes.

(b) Based on flotation feed

(c) Calculated from CO₂ assay.

(d) See "The Physical Concentration of Italian No. 2 Talc by Flotation--Investigation of Flotation Reagents", Battelle Progress Report, January 31, 1960.

(e) This is a corrected figure. The figure shown in the January 31, 1960, report was 92 per cent. A recount (in duplicate) was made of the product and showed it to be 95 per cent platy.

(f) See "The Physical Concentration of Talc Ores--Flotation of Italian No. 2 Talc", Battelle Progress Report, July 31, 1959.

Battelle Memorial Institute

Mr. H. L. Warner

3

April 12, 1960

Page _____

The results of Experiments 328 to 332, inclusive, revealed that three of the four anionic reagents tested were about as effective as the Aerosols; the data for the fourth were not conclusive.

The only reagent that did not give results as good as the Aerosols was Anatron L215, Experiment 330. It appears that the low recovery of 56.5 per cent may have been due to an insufficient amount of the reagent. Recoveries equal to that obtainable with the Aerosols were achieved with the other reagents, and in addition the dolomite content was lower. Had the anionic surface active agents been ineffective, it would have strengthened the patent application for the Aerosols.

When the results from the experiments using anionic reagents were available, Mr. Warburton transmitted this information to you by telephone. The decision was made to proceed with a limited amount of additional laboratory work in order to obtain some idea of the scope to be included in the application.

Since the experimental work previously described was limited to anionic surface active agents, it was decided to broaden the field. Therefore, cationic and nonionic surface active reagents, as well as one fatty acid type collector, were selected for the new investigations. Eight reagents were chosen, primarily because of their definite composition and availability; these are shown in Table 3.

TABLE 3. CATIONIC, NONIONIC, AND ANIONIC REAGENTS STUDIED

Trade Name	Class or Formula	Type	Main Uses
Arquad 12	Trimethyl-n-dodecylammonium chloride	Cationic	Wetting agent, detergent
Armeen 80	Octylamine	"	Collector
Armeen 160	Hexadecyl dimethyl amine	"	Collector
Span 20	Sorbitan monolaurate	Nonionic	Emulsifying agent
Iween 21	Sorbitan monolaurate polyoxy-ethylene derivative	"	Wetting agent, dispersant
Natsyn	A secondary amide of lauric acid	"	Wetting agent, detergent
Targitol NPX	Nonyl phenyl polyethylene glycol ether	"	Wetting agent
---	Oleic acid-sodium oleate emulsion	Anionic	Collector

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Mr. N. L. Warner

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April 12, 1960

Experiments 334 to 342 gave results not only equal to that obtainable with the Aerosols, 18 or OI, but better. In Experiment 342, a weight recovery of 82.6 per cent of the flotation feed with a platy talc content of 98 to 99 per cent, and a dolomite assay of 0.5 per cent was obtained in the standard 5-minute period designated Float 1. In Experiment 182, in which Aerosol 18 was used, the weight recovery in Float 1 was 70.8 per cent.

The only experiment in this series in which the results were not satisfactory was 343. In it, an emulsion of oleic acid and sodium oleate was used. The froth product from Experiment 343 contained almost 1 per cent dolomite and contained thick chunklike particles of talc, which definitely could not be classed as platy.

The conclusions from this work are as follows:

- (1) Eleven more reagents have been found, and there may be many more, that can be used to float platy talc selectively, i.e., when the starting feed is 90 per cent platy talc.
- (2) The reagents tried and shown to be successful in this study of the Italian No. 2 talc should now be tried on lower grade talc ores such as the Henderson run-of-mine talc where the magnitude of the upgrading is so much greater.
- (3) These reagents should be tried in the absence of any Dowfroths. This was not done in Experiments 328 to 343, inclusive, because the bulk of the previously reported work, and likewise the best experiments, were carried out using a combination of the Aerosols, either 18 or OI, and Dowfroth.
- (4) These reagents should now be considered for use in any new pilot-plant run.
- (5) The experiments should be confirmed by duplicate tests.
- (6) The best reagents should be evaluated with relation to their cost per ton of feed.

A portion of the closing remarks in the Battelle report, "The Physical Concentration of Italian No. 2 Talc by Flotation—Investigation of Flotation Reagents", January 31, 1960, are also applicable to this letter report and are repeated below.

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Mr. H. L. Warner

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April 12, 1960

"This report fulfills the commitment for the evaluation of additional reagents for the flotation of platy talc; undoubtedly, other reagents neither investigated nor considered might do as well or even better. However, to uncover them would require a much more comprehensive program."

The original notes on the laboratory work described in this report are recorded in Battelle Laboratory Record Book No. 16565, pages 6 to 30, inclusive.

We would be pleased to answer any questions that you may have regarding this work.

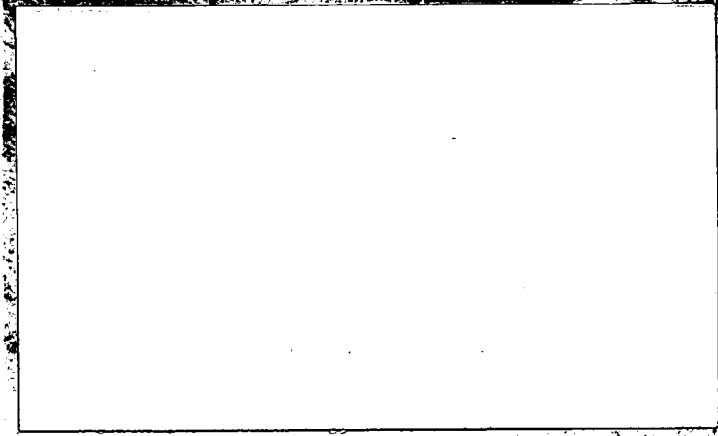
Very truly yours,

W. E. Chasa

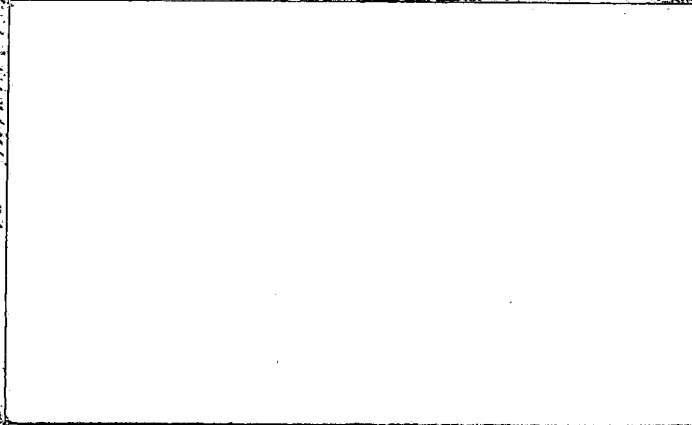
WEC:lb
In duplicate
cc: Mr. W. H. Ashton (2)

Exhibit 37

PROGRAM REPORT



BENJAMIN FRANKLIN MEMORIAL INSTITUTE



WELLS FARGO RESEARCH

AGRICULTURE FINANCIAL SERVICES INDUSTRIAL DESIGN & METALLURGY CHEMISTRY
CERAMICS CERAMIC TECHNOLOGY GRAPHIC TECHNOLOGY
ELECTRONICS ELECTRONIC TECHNOLOGY
ECONOMICS ECONOMIC ENGINEERING
OPERATIONS RESEARCH THEORETICAL
NUCLEAR ROCKETRY

PROGRESS REPORT

on

STUDIES OF THE PHYSICAL PROPERTIES
OF TALC, THEIR MEASUREMENT,
AND COMPARISON

to

JOHNSON AND JOHNSON

October 15, 1957

by

W. L. Smith

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio

K-3262-2 OK'd by O. F. Tangel and A. C. Richardson before typing.
cc: O. F. Tangel (3) A. C. Richardson R. D. Macdonald W. L. Smith (3) ✓
R. J. Anderson

Battelle Memorial Institute

5 0 5 K I N G A V E N U E C O L U M B U S I , O H I O

October 25, 1957

Dr. W. H. Lycan
Director of Research
Johnson and Johnson
New Brunswick, New Jersey

Dear Dr. Lycan:

This letter transmits six copies of our report "Studies of the Physical Properties of Talc, Their Measurement, and Comparison".

At the present stage of this investigation it can be seen that the lubricity of the Italian talc is closely related to its purity, crystalline habit, and particle-size distribution and is expressed in bulk density, surface area, porosity, and average diameter measurements. The acceptable Italian talc was found to fall within a small range of physical measurements. Lubricity was found to be controlled by the shape of the relatively small content of comparatively larger particles in the otherwise finer mixture.

It appears feasible that the slip of the Italian talc may be improved by the removal of the coarser mineral contaminants.

Your comments on the findings of this investigation will be appreciated.

Very truly yours,



W. L. Smith
Principal Geologist
Minerals Beneficiation Division

WLS:rr
Enc. (6)

R E S E A R C H F O R I N D U S T R Y

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STUDIES OF THE PHYSICAL PROPERTIES OF TALC,
THEIR MEASUREMENT, AND COMPARISON

by

W. L. Smith

SUMMARY

In order to improve the physical properties of talc it is necessary to be able to measure the differences in talc and to establish a basis for the determination of improvement. To study the lubricous property of talc, an experimental lubricity measuring device was built, and the behavior of different talc samples was compared with their other physical properties. The comparative physical measurements were made upon sized fractions and whole samples of Italian talc with conventional laboratory devices. It was found that the acceptable Italian talc fell within a small range of the physical measurements and that the samples with the more desirable slip have the greater surface area, the smaller average particle diameter, the greater ratio of voids to total volume, and the lesser bulk density. Lubricity was found to be controlled by the shape of the relatively small content of comparatively larger particles in an otherwise finer mixture. At the present stage of the investigation, the improvement of the slip of the Italian talc appears feasible by the removal of the coarser mineral contaminants.

INTRODUCTION

The talc currently used by Johnson and Johnson, obtained from Pinerolo, Italy, is believed to be a blend of five or more different grades of ore which gives a high quality, lubricous powder. In a proposal for research on the improvement of the properties of talc, dated June 4, 1956, it was proposed to study the basic properties of the acceptable Italian talc and to determine if and how the quality might be improved. The development of objective tests which might serve in the evaluation of talc was recommended, with the initial work to be done upon the product now used by Johnson and Johnson.

In order to determine improvement in the quality of talc, however, it is necessary to measure the apparently small differences between acceptable talc and talc of lower quality. Previously, measurements have been made by subjective methods only, which were thought to be of insufficient precision to measure small differences. The development and correlation of physical measurements has been undertaken to permit the measurement of improvement. The measurements of the physical properties of acceptable talc, and their range, have been made upon a series of one kilogram samples of grade "EGT Extra 00000" taken at weekly intervals from the conveyor at the Cranford, New Jersey, plant just before the talc enters the ribbon blenders. An additional large sample of talc was obtained for tests requiring larger volumes of material.

As a test for the comparative lubricity of talc samples, a lubricity board was constructed. This device, though not providing absolute values, gives reproducible

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relative figures, with which the other physical properties, which can be more easily measured, may be correlated. This study, when coupled with proposed work on abrasiveness and other properties, should indicate the course to follow in beneficiation, the primary work on which Battelle reported in a letter dated June 12, 1957. The flotation work to date has been a laboratory expedient of producing talc of superior quality for physical tests.

DISCUSSION OF LUBRICITY

This report deals with lubricity and other physical properties including particle-size distribution and surface area, which are pertinent to lubricity. The desirable quality in talc, however, is only partly a matter of lubricity. That is, talc with the desired "feel" (as sensed subjectively) is not determined either by very high or very low lubricity (diminution of friction) but by a balance of physical properties which produces a particular sensory effect. This quality is referred to in this report as slip. The primary determining factor is the platiness of fine grained particles sliding over one another under slight pressure — not being lubricous in the sense of bearings which cut down friction by transmitting the moving forces to the rolling of an intermediate body, producing point friction; not being lubricous in the sense of a viscous fluid which buffers contact; but being lubricous in the sense of a series of leaves which impart the relative movement of two bodies along several planes parallel to the contact, producing the sensation of softness of surface contact.

The nature of the sliding of the platelets is a matter of kinetics, the changes in types of motion produced by applied forces. A certain intensity of force is required to maintain sliding between any two surfaces, and this varies with the nature of the surfaces. When the applied force is distributed along numerous planes rather than between two surfaces, the resistance to relative motion between the two bodies is distributed among a series of translation movements rather than in a rotational movement or in the overcoming of inertia in one plane. Inasmuch as the coefficient of sliding friction is apparently much less between talc platelets than between talc and flesh, the total friction resulting from the sum of translation movements is necessarily less than that of flesh in contact with flesh, and thus the lubricous property is sensed. The force producing the relative motion of two bodies is applied to the several planes of free moving talc platelets, which orient their greatest surfaces normal to the force applied; the contact of this series of parallel talc planes with flesh produces the silky or smooth sensation desirable in high quality talcum powder.

Grit (granular and acicular particles), where present, introduces point friction as in bearings, or plowing and thus is the primary objectionable contaminant in talcum powder.

The lubricousness or slip of talcum powder is determined by its mineralogical purity, the crystallographic habit of the talc, the size distribution of the powder, its moisture content, and the nature of the contaminants. Most of these factors must be determined petrographically, often on separated fractions of the powder. Other physical properties, such as surface area, average diameter, porosity, and bulk density, may be measured mechanically. Such physical measurements have been made, and the data have been correlated to determine which properties are significant in ground talc which has the desired slip. Measurements have been made to establish the

optimum limits of many of the properties relevant to lubricity. Data relevant to color, reflectance, moisture content, alkalinity, and abrasiveness will appear in a subsequent report.

THE ROLE OF MINERALOGICAL PURITY IN LUBRICITY

The Italian talc contains from about 97 to more than 99 per cent pure mineral talc. The predominant contaminant is carbonate, which is present in all size fractions, being slightly more abundant in the fines. Among other contaminants, present in trace amounts, are amphiboles, rutile, zircon, apatite, and titanite. The Italian talc is essentially free of opaques. The contaminants are generally prismatic or angular particles which act as grit and introduce point friction. A few such equidimensional or acicular particles present in an otherwise platy talcum, particularly if the grit is present in the coarser sizes, may be easily noticed subjectively. They diminish the lubricous feeling by the introduction of plowing, bearing-like particles, and the disruption of the lamellar movement of the talc particles. Inasmuch as the contaminants generally have diameters considerably greater than the thickness of talc platelets, their removal would improve the slip of any platy talc in which they occur in an effective amount. The small percentage of contamination in the Italian talc is an effective amount, as demonstrated by lubricity tests on a sample upgraded by froth flotation.

Further discussion of the nature of the impurities of talc was reported in earlier Battelle reports to Johnson and Johnson dated May 11, 1955^{(1)*}, February 29, 1956⁽²⁾, May 28, 1957⁽³⁾, and July 25, 1957⁽⁴⁾.

THE ROLE OF THE CRYSTALLOGRAPHIC HABIT OF TALC IN LUBRICITY

Platy talc is the most desirable for the purposes of the Sponsor. Whereas acicular and granular talc particles plow or roll, producing point friction, platy particles slide over one another producing the soft lubricous sensation desirable in talcum powder. The Italian talc averages about 10 per cent fibrous or acicular particles and about 90 per cent platelets. The amount of granular talc particles is negligible. Fibrous and granular particles of talc, though physically softer than the foreign mineral contaminants of talc ore, are none the less undesirable - if to a lesser degree. Such particles are most undesirable when present in the larger grain sizes where these crystals or aggregates may act as bearings or irritants.

Whereas different minerals may be separated from one another by physical processes, such as the removal of carbonates from talc by flotation, more difficulty is involved in separating particles of monomineralic, impalpable powder on the basis of their crystallographic habit, except where the crystal types concentrate in specific size fractions. Until beneficiation procedures for concentrating talc with the desired crystallographic habit are developed, talc which has the crystallographic habit preferred must be obtained by selective mining.

A detailed discussion of the various crystallographic habits of talc appears in a Battelle report to Johnson and Johnson dated February 29, 1956⁽²⁾.

* References are given on page 23.

N THE MEASUREMENT OF LUBRICITY

Discussion

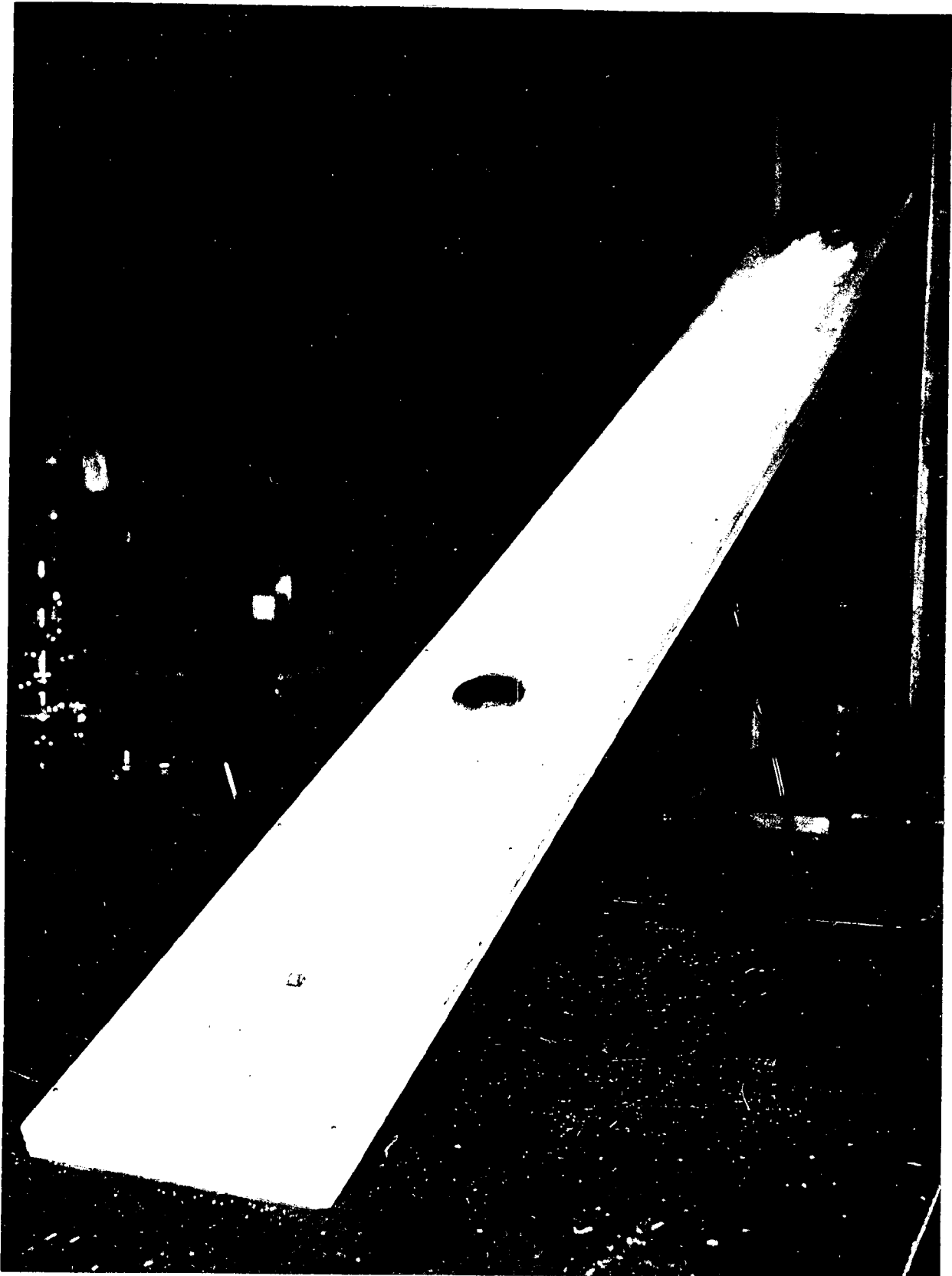
Although the desired property of talc, the slip or optimum balance of size distribution and friction is only partly a matter of lubricity, it is correlative within certain limits of lubricity. A standard method of objectively measuring the lubricousness of talc has not been devised previously. The lubricity has been determined comparatively by feeling a pinch of powder between the fingers. People experienced in so testing talc subjectively are able to distinguish fine differences in quality. Since the desirable and undesirable qualities of talc are a subjective matter, it is likely that subjective testing is preferable. However, since the subjective tests are a matter of sensation, involving human reaction to several physical properties, such tests are of little help in devising methods of improving the physical properties of talc or of measuring small differences in particular properties. Because of this it was necessary to build a device to objectively test and measure lubricity, apart from the other properties which contribute to the desirability of talc.

It is not to be inferred that an objective test can replace the subjective test or that pleasantness of sensation is mechanically measurable; however, the physical properties which contribute to the unctuousness of talc can be measured and their optimum limits can be determined. Thus the means of improvement of talcs can be visualized. The figures obtained on the lubricity-board experiments are compared with the more easily made measurements of other physical properties in order to determine if there is a correlation and to establish the desirable limits of particular properties in acceptable Italian talc.

The Lubricity Board

In order to obtain quantitative measurements of talc samples, against which the measurements of other physical properties could be compared, a simple machine was constructed with a minimum of interacting physical factors. This device consists of a wooden plane inclined at 25 degrees, which is covered with talc (Figure 1). The lubricity is determined by measuring the time it takes a 226-gram steel puck to slide over two microswitches spaced 5 feet apart (Figure 2). The microswitches actuate an electric timer.

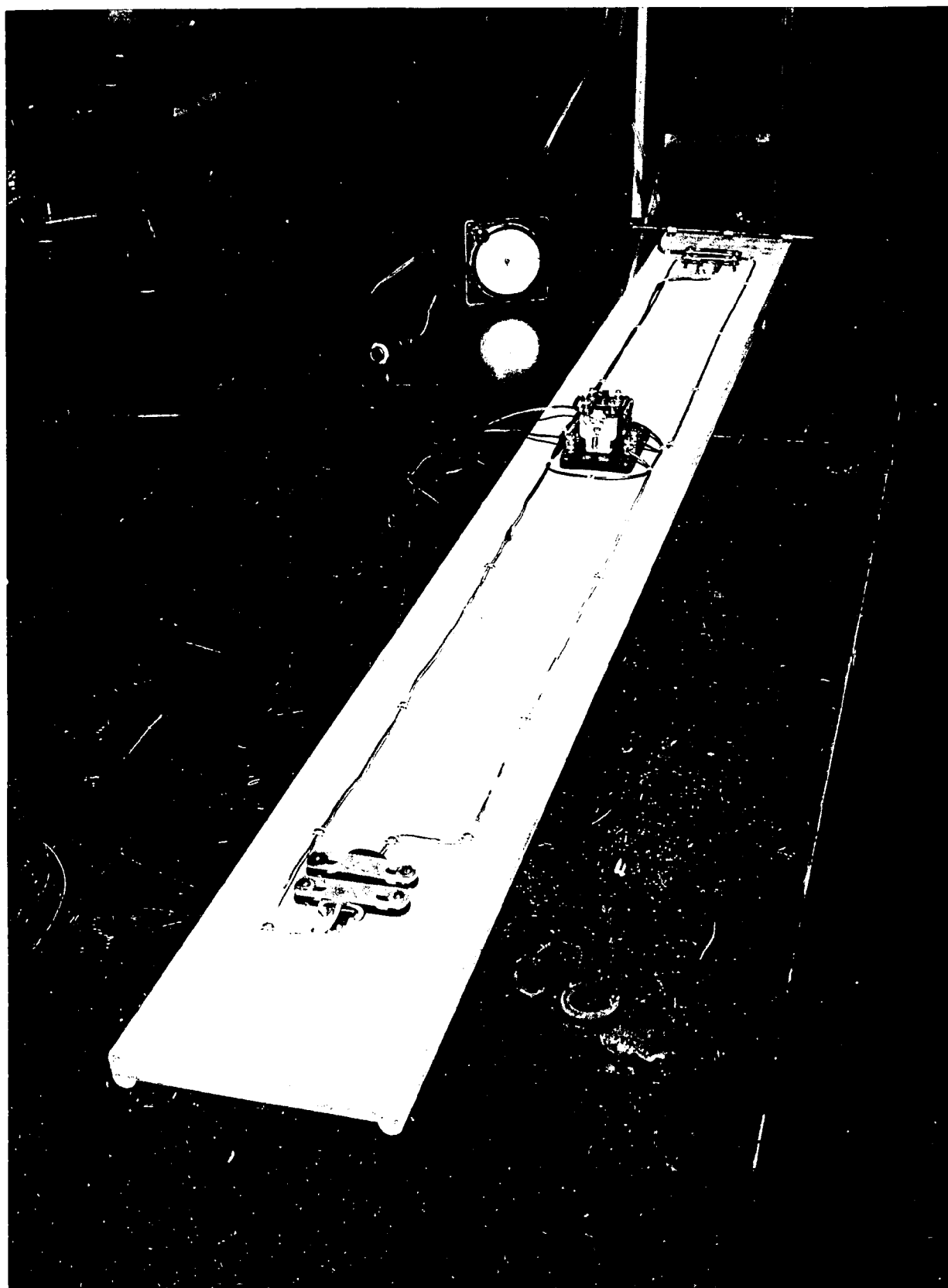
The lubricity board was designed as a preliminary device in making lubricity experiments; however, a routine method of measurement has been established and the device has demonstrated a reproducibility with an accuracy of more or less 1 per cent. Although more precise machines might be built, the lubricity board has proven to be an adequate means of measuring the comparative lubricity of talc samples and to be adequately precise for the comparison of data from other physical measurements. The measurements made on the lubricity board are presented in terms of .xxx second, the figures representing the average of fifty readings. A typical set of figures is shown in Table 1. A description of the lubricity board and the technique of its operation comprises Appendix A.



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FIGURE 1. THE LUBRICITY BOARD, SHOWING DESCENT OF STEEL PUCK

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N40208

FIGURE 2. UNDERSIDE OF LUBRICITY BOARD, SHOWING MICROSWITCHES AND
ELECTRIC TIMER CONNECTED TO LOCK-IN RELAY

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TABLE 1. TYPICAL DATA FROM LUBRICITY-BOARD MEASUREMENT OF ITALIAN TALC SAMPLE (CRANFORD, 12/22/56)

Measurement in Seconds				
Series 1	Series 2	Series 3	Series 4	Series 5
0.96 ^(a)	0.97	0.98	0.97	0.97
0.98	0.96	0.97	0.96	0.97
0.95	0.96	0.97	0.96	0.96
0.95	0.95	0.97	0.98	0.95
0.97	0.96	0.96	0.98	0.96
0.97	0.95	0.96	0.97	0.94
0.96	0.96	0.97	0.96	0.97
0.95	0.97	0.98	0.98	0.98
0.97	0.96	0.97	0.97	0.95
0.94	0.97	0.97	0.99	0.97
Average 0.965 second				

(a) Lubricity board newly covered for each series of ten slides.

Contrary to preconceived ideas about the behavior of solid lubricants, the puck was found to slide faster on poorer grades of talc than on cleaner samples with better slip. The controlling factor is the presence of contaminants or equidimensional particles which act as bearings while purer talc, within the limits of the particular size distribution, presents a surface composed of flat platelets, producing more friction and slowing the descent of the puck.

It is not suggested at this time that Johnson and Johnson conduct similar experiments on a lubricity board. Until the lubricity studies are completed, it is intended that the lubricity board serve only as a basis for comparison with other measurements by which the physical properties which control lubricity can be evaluated.

The Lubricity of Talc Samples

Lubricity-board measurements were made on 15 samples of talc obtained from the Cranford plant of Johnson and Johnson, collected at regular intervals from August 10 to December 22, 1956. Table 2 lists the figures obtained for each sample. The readings ranged from 0.936 second for the sample which permitted the fastest descent of the puck to 1.083 seconds for that sample which most slowed the descent.

To test the hypothesis that the faster descents were due to bearing-like contaminants, the lubricity figures were compared to those of the percentage of contamination. Table 2 lists the amount of contamination as compared to the lubricity of the samples. The contamination figures represent microscopically identifiable particles and do not include the impalpable fines. Although correlation was not perfect, the relationship of contamination to lubricity is clear in the extreme instances. The talc containing the greater amount of contaminants permitted the faster descents on the lubricity board. The slight differences in contamination were not discernible subjectively.

TABLE 2. LUBRICITY-BOARD MEASUREMENTS AND PER CENT CONTAMINATION OF TALC SAMPLED AT CRANFORD, NEW JERSEY, SHOWING RELATION OF LUBRICITY TO PURITY OF SAMPLE

Date Sampled	Contamination ^(a) , per cent	Lubricity-Board Measurements, seconds
9-6-56	<1	1.083 (slowest)
11-6-56	1	1.053
9-12-56	<1	1.030
9-19-56	<1	1.028
10-18-56	1	1.025
8-10-56	1	1.021
9-27-56	1	1.017
8-28-56	2	1.007
10-29-56	1-2	1.006
10-4-56	1-2	0.982
8-20-56	2	0.971
10-12-56	2-3	0.968
12-22-56	2	0.965
11-30-56	2-3	0.952
11-15-56	2	0.936 (fastest)

(a) Determined petrographically.

Inasmuch as the contamination figures were small, were close together, and could be prejudiced, the contaminants were removed from a sample of talc by froth flotation and the products were tested on the lubricity board. The test results, which are also noticeable subjectively, are given in Table 3.

TABLE 3. LUBRICITY-BOARD DATA ON FLOTATION PRODUCTS OF ITALIAN TALC, SHOWING DELETERIOUS EFFECT OF CONTAMINATION ON LUBRICITY

Product	Lubricity-Board Measurement, seconds
Starting sample	0.990
Float product ^(a)	1.046 (superior)
Nonfloat product ^(b)	0.873 (inferior)

(a) Essentially pure talc, representing 90 per cent of starting sample.

(b) 85 per cent talc, 15 per cent contaminants, representing 10 per cent of starting sample.

The essentially pure talc product produced a slower descent of the steel puck than did the unseparated sample, and the flotation tailings permitted a descent considerably faster than did the unseparated sample. It may be concluded, on the basis of several experiments on the lubricity board, that the purer talc with the better slip requires a longer time for the puck to slide, while the samples more contaminated with granular "bearings" permit faster descents. Although the details of practical beneficiation of this talc by froth flotation have yet to be worked out, the amenability of the talc to

flotation and the obvious improvement in the purity and slip of the product indicate that beneficiation is a feasible consideration for the improvement of the Italian talc.

C THE RELATIONSHIP OF LUBRICITY TO
PARTICLE-SIZE DISTRIBUTION

Discussion

The desirable slip in talcum powder does not depend alone on the physical lubricity of the mineral but on numerous interdependent physical properties, one of the more important being particle-size distribution. The relative amount of grains in different size fractions, the extreme sizes, and the crystalline habit of grains of different sizes play a major role in lubricity. Comparatively larger grains in an otherwise fine powder may roll like bearings, plow, or act as barriers to the free movement of smaller platelets. Too large an amount of very fine grains may behave as "flour" despite their particle shape and may disrupt or may clog the movements of larger platelets.

Size distribution is reflected in bulk density, porosity, surface area, and average diameter measurements. The samples of Italian talc were found to have physical properties which fall within a small range of many of these measurements and which can be related to lubricity in some instances. Too many variable properties exist in talc to assess specific requirements for many physical measurements; however, in testing for acceptable talcs, those ores with properties similar to the Italian talc should also be expected to have measurements within or close to the range of those obtained on the Italian talc. The measurements should be a useful guide in the blending of talcs and for the rejection of inferior grades.

Battelle wishes to emphasize that immediate conclusions should not be drawn from the following physical measurements alone, inasmuch as they represent but half of the story. A forthcoming report which will deal further with lubricity and other physical properties such as whiteness, abrasiveness, and moisture content, will expand the list of the properties required for an acceptable talc. Although many talcs may be rejected because they fail to meet certain physical requirements presented here, acceptability involves additional factors.

Particle-Size Distribution in Italian Talc

In a previous report to Johnson and Johnson⁽²⁾, Battelle reported a dry screen analysis and a particle-size distribution of Italian talc based on both dry screening and sedimentation in water. These findings are repeated in Table 4. Further, extensive particle-size distribution studies were made showing that three replicate analyses of a large sample of Italian talc were closely reproducible and in close agreement with the earlier analyses, although obtained from a separate sample (Table 5). Appendix B contains a description of the procedure for particle-size analysis.

TABLE 4. PREVIOUSLY REPORTED PARTICLE-SIZE DISTRIBUTION DATA⁽²⁾ ON ITALIAN TALC

a. Dry Screen Analysis

Tyler Mesh Size	Weight Per Cent
+150	0.1
-150+200	1.8
-200+270	2.1
-270+325	13.5
-325	82.5
	<u>100.0</u>

b. Approximate Particle-Size Distribution Based on Dry Screening and Sedimentation in Water

Size	Approximate Weight Per Cent
-100+200 Mesh	2
-200+325 Mesh	16
-325 Mesh + 15 Microns	62
-15 Microns + 10 Microns	9
-10 Microns	11
	<u>100</u>

TABLE 5. PARTICLE-SIZE DISTRIBUTION OF THREE SAMPLES OF ITALIAN TALC

Size	Average Weight Per Cent	Per Cent Deviation From Mean
+200 mesh ^(a)	1	0.12
-200 mesh + 325 mesh	10	0.97
-325 mesh + 400 mesh	7	1.3
(38 microns)		
-38 microns + 30 microns	57	5.18
-30 microns + 15 microns	12	0.8
-15 microns	13	3.1
	<u>100</u>	

(a) Tyler.

To check the variation in particle-size distribution of the talc samples from Cranford, a series of measurements by dry screening and sedimentation were made on 12 samples. Table 6 lists the weight per cent of each size fraction. One of the samples, Cranford 10/4/56, might be eliminated statistically from the sample population; however, the variation is real and its data are included in the weight per cent deviation from the mean (Table 7). The effect of the variant sample shows clearly in the measurements of average particle size, specific surface, bulk density, and porosity (Tables 12, 15). The cause of the variation is not obvious petrographically, the sample being similar to the others except in size distribution. This variant sample demonstrates that the Pinerolo product is not uniform. Also, since the larger coarse fraction does not cause the expected effect on the lubricity measurement as do variations within the normal size distribution population, it shows that the matter of lubricity is more complex than is indicated by variations within a small range in particle-size distribution.

The Cranford samples have minor variations in particle-size distribution. In all of the samples, however, the -400 mesh (38 micron) + 30 micron fraction constitutes about one-half of the sample, with minor amounts in the smaller and larger fractions. This distribution should be kept in mind should platy talcs of other distributions be considered. Inasmuch as the size distribution may be as much a matter of the grinding and blending of ores as of the physical nature of the ore, fabrication of acceptable talcum powder from lower grade ore might be accomplished by a proper blend of sized fractions of platy talc.

Correlation of Lubricity With Particle-Size Distribution Data

In order to correlate the particle-size distribution and lubricity data, a large sample of Italian talc was sized and the size fractions were tested on the lubricity board. Experiments clearly showed that the coarser fractions permitted a faster descent of the puck while the finer fractions produced a slower descent. This is apparently due to the more equidimensional bearing-like particles in the coarser fractions. Table 8 demonstrates the relationship of particle size to lubricity, showing the larger, more desirable, lubricity figures for the fines, the lower for the coarser, gritty fraction.

Inasmuch as the lubricity of talc involves the physical properties of material of various grain sizes, lubricity measurements were made on various proportional mixtures of specific particle-size fractions and on powders from which specific particle-size fractions were removed. In order to determine if the over-all lubricity was controlled by the coarse or by the fine sizes, a series of lubricity measurements was made on proportional mixtures of the fine (-400 mesh) and coarse (+250 mesh) sizes. Table 9 clearly shows that the control is in the relative amount of coarser to finer grains. That is, a small amount of coarse particles added to an otherwise fine powder has a pronounced adverse effect on lubricity, whereas a similar percentage addition of fine particles to an otherwise coarse grained powder has comparatively little effect on lubricity. It may be concluded from this study that the removal of the coarser particles, which tend to be more equidimensional, will improve the slip. On the other hand, the addition of fines to gritty or granular powders makes comparatively little improvement.

TABLE 6. PARTICLE-SIZE DISTRIBUTION OF TALC SAMPLED AT CRANFORD PLANT

Date Collected	Weight Per Cent of Size Fractions					
	+200 Mesh	-200 Mesh +325 Mesh	-325 Mesh +400 Mesh	-400 Mesh +30 Microns	-30 Microns +15 Microns	-15 Microns
9-6-56	0.47	5.44	6.83	65.72	10.76	10.78
11-6-56	0.51	5.13	7.75	56.66	16.49	13.46
9-12-56	0.92	8.30	7.85	60.76	10.23	11.94
9-19-56	0.84	5.54	7.65	55.79	16.42	13.88
10-18-56	0.96	7.86	7.27	58.07	13.32	12.52
9-27-56	0.59	4.48	6.77	56.52	15.93	15.71
8-28-56	0.50	4.34	6.89	56.39	16.18	15.71
10-4-56(a)	1.22	6.38	9.36	40.02	31.74	11.28
8-20-56	0.65	6.08	7.98	57.53	16.64	11.12
12-22-56	0.88	3.42	12.30	52.27	20.01	11.12
11-30-56	0.72	6.38	10.33	57.86	11.21	13.50
11-15-56	0.88	6.93	9.91	48.72	22.08	11.48

(a) See comment under "Particle-Size Distribution in Italian Talc".

B A T T E L L E M E M O R I A L I N S T I T U T E

TABLE 7. DEVIATION IN PARTICLE-SIZE DISTRIBUTION IN WEIGHT PER CENT OF TALC SAMPLED AT THE CRANFORD PLANT

Size	Deviation, weight per cent (Excluding Sample 10/4/56)	Deviation, weight per cent (Including Sample 10/4/56)
+200 mesh ^(a)	0.26	0.39
-200 mesh + 325 mesh	2.44	2.44
-325 mesh + 400 mesh (38 microns)	1.78	1.78
-38 microns + 30 microns	8.50	12.85
-30 microns + 15 microns	5.42	10.75
-15 microns	3.72	3.72

(a) Tyler.

TABLE 8. RELATIONSHIP OF LUBRICITY TO PARTICLE SIZE

Tyler Mesh Size	Lubricity-Board Measurement, seconds
Unseparated	0.990
+200	0.889
-200+250	0.951
-250+270	0.980
-270+325	1.030
-325+400	1.043
-400	1.099

TABLE 9. THE LUBRICITY OF MIXTURES OF COARSE AND FINE SIZES OF TALC, DEMONSTRATING THE CONTROL TO BE IN THE COARSE FRACTIONS

Per Cent Fines (-400 Mesh)	Per Cent Coarse (+250 Mesh)	Lubricity-Board Measurement, seconds	Difference in Lubricity
0	100	0.951	
10	90	0.951	.000
25	75	0.960	.009
50	50	0.970	.010
75	25	0.986	.016
90	10	1.038	.052
100	0	1.099	.061

Further measurements of the effect of particle-size distribution on lubricity were made by testing whole powder from which different size fractions had been removed. The measurements, Table 10, demonstrate that removal of the fines decreases the quality of the powder, whereas removal of the coarse fractions improves it. It would have to be determined by further tests of beneficiation products whether it is most advisable to remove entire size fractions or merely the small percentage of coarse contaminants.

TABLE 10. LUBRICITY MEASUREMENTS OF ITALIAN TALC SAMPLES FROM WHICH SPECIFIC PARTICLE-SIZE FRACTIONS HAVE BEEN REMOVED

X Represents Fractions Removed From Whole Powder
U Represents Fractions Tested

Tyler Mesh Size	Lubricity-Board Measurement of ^(a) Size Fractions	Test 1	Test 2	Whole Powder	Test 3	Test 4
+200	0.889	U	U	U	X	X
-200+250	0.951	U	U	U	X	X
-250+270	0.980	U	U	U	U	X
-270+325	1.030	X	U	U	U	U
-325+400	1.043	X	U	U	U	U
-400	1.099	X	X	U	U	U
Lubricity-Board Measurement		0.945	0.963	0.990	1.038	1.068
Approximate Weight Per Cent of Fractions Removed		97.	82.	0.	2.	3.

(a) Repeated from Table 8 for comparative purposes.

MOISTURE CONTENT

Of considerable importance to the lubricity of talc is its moisture content. This topic is more thoroughly treated in a forthcoming report. It is important, however, to note here that an increase in moisture content slows the descent of the puck on the lubricity board and falsely indicates superior lubricity. All of the Italian talc was found to contain a moisture content in the hundredths of one per cent. Analyses of various size fractions show that the moisture content is higher in the fine sizes, possibly due to adsorption on the greater surface area.

MEASUREMENT AND CORRELATION OF OTHER
PHYSICAL PROPERTIES RELATED TO LUBRICITYSurface Area Determinations by Nitrogen Adsorption

The relationship of lubricity to particle-size distribution has been shown to be a matter of friction and surface area, the finer platelets having the greater surface area per unit of weight.

Four samples of Italian talc from Cranford were measured for their surface area using the Brunauer, Emmett, Teller technique of nitrogen adsorption at liquid nitrogen temperatures (Table 11).

TABLE 11. SURFACE AREA MEASUREMENTS OF ITALIAN TALC, COMPARED WITH LUBRICITY-BOARD MEASUREMENTS

Cranford Sample Date	Lubricity-Board Measurement, seconds	BET Surface Area Measurement, m ² /g
9-6-56	1.083	3.57
9-12-56	1.030	3.18
9-19-56	1.028	2.93
10-4-56	0.982	2.26

The tests show a relationship between surface area and lubricity, the samples with the greater surface area also having the larger lubricity measurements. The values are believed to be accurate to within 5 per cent.

Average Diameter of Particles

An easily operated instrument for rapid particle-size determinations is the Fisher Subsieve Sizer. The instrument measures average particle size by determining the resistance to the flow of air by a weighed sample of powder under standard packing conditions. On the basis of the principle that a fluid meets less resistance to flow while

TABLE 12. COMPARISON OF THEORETICAL AVERAGE-DIAMETER MEASUREMENTS AND SPECIFIC SURFACE TO LUBRICITY-BOARD MEASUREMENTS OF CRANFORD SAMPLES

Cranford Collection Date	Lubricity-Board Measurement, seconds	Theoretical Average ^(b) Particle Diameter	Specific Surface, cm ² /g
9-6-56	1.083	2.60	8392
11-6-56	1.053	2.65	8233
9-12-56	1.030	2.60	8392
9-19-56	1.028	2.45	8905
10-18-56	1.025	2.60	8392
8-10-56	1.021	2.80	7792
9-27-56	1.017	2.80	7792
8-28-56	1.007	2.75	7934
10-29-56	1.006	2.80	7792
10-4-56 ^(a)	0.982	3.30	6612
8-20-56	0.971	2.90	7524
10-12-56	0.968	2.90	7524
12-22-56	0.965	3.10	7038
11-30-56	0.952	3.30	6612
11-15-56	0.936	3.20	6818

(a) See comment under "Particle Size Distribution in Italian Talc".

(b) Determined on Fisher Subsieve Sizer.

penetrating a bed of coarse particles than while penetrating a bed of fine particles, a figure is derived which disregards the shape of the individual grains, porosity, size distribution and other variables. Inasmuch as the average diameter figure represents a theoretical sphere, the data are of relative rather than actual value. Average diameter measurements made on the Fisher Subsize Sizer are shown in comparison with lubricity measurements (Table 12), demonstrating the correlation of small average diameters to talc with the larger lubricity measurement and larger average diameters to talc with the lower, less desirable, lubricity measurements. A clear-cut correlation of the theoretical average-particle-diameter measurements with the lubricity-board measurements is shown in Table 13.

TABLE 13. RELATIONSHIP OF LUBRICITY-BOARD MEASUREMENTS TO THEORETICAL AVERAGE DIAMETERS ON SIZED FRACTIONS OF ITALIAN TALC

Tyler Mesh Size	Lubricity-Board Measurements, seconds	Theoretical Average Particle Diameter, microns ^(a)
Unseparated	0.990	2.60
+200	0.889	7.40
-200+250	0.951	3.60
-250+270	0.980	2.50
-270+325	1.030	2.35
-325+400	1.043	2.25
-400	1.099	2.10

(a) Determined on Fisher Subsize Sizer.

Specific Surface Calculated From Average Diameter

The average particle diameter as determined on the Fisher Subsize Sizer may, by use of a simple equation, * be expressed in terms of specific surface in square centimeters per gram of dry powder. This is a simpler, less expensive method than nitrogen adsorption. Specific surfaces, as calculated from the average-particle-diameter measurements, are presented in Table 12 in comparison with lubricity. The calculated specific-surface figures, because of their derivation from average-particle-diameter measurements, are inversely correlative with particle size. The samples with the greater specific surfaces are those which impede the slide of the puck on the lubricity board, and which have better slip, while the samples with the smaller specific surfaces, those containing the larger particles, are the samples permitting faster descents of the puck on the lubricity board.

As in the case of the average particle-diameter measurement, the specific-surface calculations represent theoretical spheres which, since the powder is composed of platelets, are of relative rather than exact value. Whereas the surface area as determined by gas adsorption is relatively exact, the value of the surface-area figures derived from the theoretical average-particle-diameter measurements is purely comparative.

$$*\text{Specific surface (cm}^2\text{/g)} = \frac{6 \times 10^4}{\text{average diameter } (\mu) \times \text{specific gravity of talc}}$$

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The relationship of specific surface to the lubricity of sized fractions of Italian talc is presented in Table 14, which shows that the fractions with the better lubricity also have the greater surface areas.

TABLE 14. CORRELATION OF SPECIFIC SURFACE AND LUBRICITY-BOARD MEASUREMENTS OF SIZED FRACTIONS OF ITALIAN TALC

Tyler Mesh Size	Lubricity-Board Measurements, seconds	Specific Surface, cm ² /g
Unseparated	0.990	8392
+200	0.889	2948
-200+250	0.951	6061
-250+270	0.980	8727
-270+325	1.030	9284
-325+400	1.043	9697
-400	1.099	10390

Porosity

A measurement of porosity, independent of the other measurements, may be made on the Fisher Subsieve Sizer. The porosity figure represents the ratio of voids to the total volume of the packed sample, in a range of 0.40 to 0.80. Inasmuch as part of the test involves a manual operation, the results are subject to a human error. The porosity figures, however, are reproducible through the second decimal place. The range in porosity, 0.448 to 0.490, determined on the Cranford samples, is a relatively small range and should, by its close limits alone, be of assistance in evaluating Italian talc (Table 15). The more porous powders, those with the greatest amount of asymmetrical, platy grains, are also those with the larger lubricity-board measurements, hence the better slip. Correspondingly, the samples with the lower porosity, those containing the greater amount of equidimensional grains, are the powders which have the lower lubricity-board measurements.

Table 16 shows the porosity of sized fractions of Italian talc as compared with its lubricity-board measurements. The porosity is clearly shown to be less in the coarser fractions with the poorer slip and greater in the finer fractions.

TABLE 15. POROSITY, BULK DENSITY, AND LUBRICITY OF CRANFORD SAMPLES

Cranford Collection Date	Porosity Ratio	Bulk Density, lb/cu ft	Lubricity-Board Measurements, seconds
9-6-56	0.490	22.942	1.083
11-6-56	0.480	22.958	1.053
9-12-56	0.475	23.259	1.030
9-19-56	0.456	23.437	1.028
10-18-56	0.452	22.860	1.025
8-10-56	0.460	23.528	1.021
9-27-56	0.464	23.096	1.017
8-28-56	0.470	22.642	1.007
10-29-56	0.461	22.491	1.006
10-4-56 ^(a)	0.475	24.061	0.982
8-20-56	0.460	23.756	0.971
10-12-56	0.455	23.429	0.968
12-22-56	0.452	22.616	0.965
11-30-56	0.448	22.725	0.952
11-15-56	0.450	22.583	0.936

(a) See comment under "Particle-Size Distribution in Italian Talc".

TABLE 16. CORRELATION OF POROSITY AND LUBRICITY-BOARD MEASUREMENTS OF SIZED FRACTIONS OF ITALIAN TALC

Tyler Mesh Size	Lubricity-Board Measurements, seconds	Porosity Ratio
Unseparated	0.990	0.448
+200	0.889	0.401
-200+250	0.951	0.426
-250+270	0.980	0.439
-270+325	1.030	0.446
-325+400	1.043	0.442
-400	1.099	0.455

Bulk Density

The bulk density of ground talc may be measured on a Scott Volumeter. The Cranford talc samples were found to have bulk densities ranging between 22 and 25 pounds per cubic foot. Table 15 lists the bulk densities of the Cranford talc samples. The bulk-density measurement is not precise enough to accurately compare small differences but is valuable in establishing a range of acceptability. When sized fractions are tested, the bulk density is seen to have inverse relationships with porosity and specific surface and to have a direct relationship with average particle size. Thus, as shown in Table 17, bulk density is inversely correlative with lubricity as a function of particle size. The coarser fractions, with poorer slip have the higher bulk density; the finer fractions having the lower bulk density. The relationship of bulk density, moisture content, and lubricity is presented in a forthcoming report.

TABLE 17. THE RELATIONSHIP OF BULK DENSITY TO LUBRICITY-BOARD MEASUREMENTS OF SIZED FRACTIONS OF ITALIAN TALC

Tyler Mesh Size	Lubricity-Board Measurements, seconds	Bulk Density, lb/cu ft
Unseparated	0.990	23.030
+200	0.889	34.261
-200+250	0.951	26.645
-250+270	0.980	20.721
-270+325	1.030	19.335
-325+400	1.043	19.139
-400	1.099	16.894

CONCLUSIONS

Because this study represents but part of the picture of evaluating acceptable talc by means of its physical properties, it is not possible to state final conclusions without qualifications. Several relationships between physical properties, however, have been established for acceptable Italian talc and the range of their variations have been measured. A forthcoming report including studies of other physical properties will add to the picture and will indicate the course to follow for beneficiation of the Italian talc in order to improve its physical properties.

The physical properties of the Italian talc samples have been measured and the following ranges in values were obtained:

- (1) Contamination: from less than 1 to more than 3 per cent.
- (2) Crystallographic habit: more or less constantly 90 per cent platy, 10 per cent fibrous.
- (3) Lubricity-board measurement: from 0.936 to 1.083 seconds.
- (4) The ratio of voids to total volume: from 0.45 to 0.49.
- (5) Theoretical average particle diameter: from 2.45 to 3.30 microns.
- (6) Bulk density: from 22.49 to 24.06 lbs/cu. ft.
- (7) Specific surface: from 6612 to 8905 cm²/g.
- (8) Moisture content: hundredths of one per cent.
- (9) Particle-size distribution:

+200 mesh	0.47 to 1.22 per cent
-200+325 mesh	3.42 to 8.30
-325+400 mesh (38 microns)	6.77 to 10.33
-38 microns + 30 microns	40.02 to 65.72
-30 microns + 15 microns	10.23 to 22.08
-15 microns	10.78 to 18.23.

Physical measurements on sized fractions of Italian talc showed the coarser particle fractions to have lower, less desirable, measurements on the lubricity board and the finer fractions to have the larger, more desirable, measurements. The sized fractions with the preferable lubricity were found to have the higher porosity and specific surface and the smaller particle size and bulk density (Table 18).

Lubricity-board studies on Italian talc fabricated to particular size distributions show that the lubricity is controlled by the relatively small amount of comparatively larger grains in an otherwise finer mixture. Lubricity-board studies also show that the lubricity of the Italian talc may be improved by the removal of the coarser size fractions. This is not a simple matter, however, as it involves the variation in size of the abrasive particles.

TABLE 18. SUMMARY OF PHYSICAL PROPERTIES OF SIZED FRACTIONS OF ITALIAN TALC

Tyler Mesh Size	Lubricity-Board Measurements, seconds	Average Diameter, microns	Specific Surface, cm ² /g	Porosity Ratio	Bulk Density, lb/cu ft
Unseparated	0.990	2.60	8392	0.448	23.030
+200	0.889	7.40	2948	0.401	34.261
-200+250	0.951	3.60	6061	0.426	26.645
-250+270	0.980	2.50	8727	0.439	20.721
-270+325	1.030	2.35	9284	0.446	19.335
-325+400	1.043	2.25	9697	0.442	19.139
-400	1.099	2.10	10390	0.455	16.894

B A T T E L L E M E M O R I A L I N S T I T U T E

Measurements on flotation products show that the removal of the small per cent of contaminants improves the lubricity of the talc .

The physical properties of the Italian talc can be improved, with the least possible loss of sample, by removing the mineral contaminants from either the coarse fractions or from the sample as a whole. This appears to be one clear cut course to follow in improving the Italian talc.

(The original notes on the laboratory work described in this report are in Battelle Laboratory Record Books No. 12667, pages 1 through 71, and No. 13034, pages 1 through 77. The work was done in the period from November 7, 1956, to September 30, 1957.)

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APPENDIX A

DESCRIPTION OF LUBRICITY BOARD
AND TECHNIQUE OF OPERATION

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A-1 and A-2

APPENDIX A

DESCRIPTION OF LUBRICITY BOARD AND TECHNIQUE OF OPERATION

The experimental device described as the lubricity board in this report consists of a wooden plane inclined at 25 degrees, which is lightly, but completely, covered with talc. The lubricity is determined by measuring the time it takes a steel puck to slide over two microswitches which actuate an electric timer.

The inclined plane is made of 6-ply birch plywood, 3/4 inch thick, 6 inches wide, and 6 feet long. The even-grained wood was sanded smooth to prevent the grain from influencing the descent of the puck. Twenty-five degrees was selected as the inclination from horizontal after much experimentation which showed it to be the minimum angle at which a sustained slide could be made on all of the Italian talc samples.

The microswitches are located 6 inches from each end of the slide, in the middle of the board, making the measured path a length of 5 feet. The microswitches are connected to a double-pole, 115-volt, Struthers-Berm lock-in relay which actuates a Standard Electric Time Company electric timer. The steel puck weighs 226 grams, is 3/4 inch by 2-1/2 inches, has rounded edges, and presents a circular sliding surface of 1-3/4 inches diameter. Such are obtainable from amusement equipment distributors as a piece used in the game of American Shuffleboard. One flat surface of the puck was ground smooth and polished for the lubricity experiments.

The talc is applied to the lubricity board from a 9-ounce Johnsons' Baby Powder can until a thin even layer is present over the measured path. The puck is manually released from a dead start from the top of the slide, 6 inches above the first microswitch. For purposes of eliminating errors of freak descents, lubricity is measured as the average of 50 runs. The board is newly covered with talc after each 10 runs, although no difference in lubricity measurements could be accounted for between those early and late in a series. The puck was washed in warm water and thoroughly dried between runs.

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APPENDIX B

PROCEDURE FOR PARTICLE-SIZE ANALYSIS

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B-1

APPENDIX B

PROCEDURE FOR PARTICLE-SIZE ANALYSIS

In a previous report to Johnson and Johnson from Battelle⁽²⁾ a procedure for sizing Italian talc was outlined. For purposes of the present investigation, the following procedure was developed by D. A. Jacobs of the Battelle staff.

One hundred grams of talc is wet screened at 325 mesh with water. The +325 mesh product is dried and dry screened on a Ro-Tap for 30 minutes producing +200, 200 x 325, and -325 mesh fractions. The -325 mesh fraction of the dry screening is combined with the -325 mesh product of the wet screening. A suspension of -325 mesh material is allowed to settle through a 10-centimeter column in a 4-liter beaker to which sodium silicate has been added in the amount of 1 pound per ton, and agitated for a period of 10 minutes. The sodium silicate is added to the first 30-minute settling of each sample only. At the end of the first 30-minute cycle, the supernatant column of liquid is siphoned off. This liquid contains the -15 micron fraction. Four cycles are required to remove the -15 micron fraction entirely. Another series of 4 cycles with settling times of 5 minutes produces the 15 x 30-micron fraction, which is siphoned off, plus sands of 30 microns x 325 mesh. The sands are dried and dry screened at 400 mesh on a Ro-Tap for 30 minutes, producing 325 x 100 mesh and 400 mesh x 30 micron fractions. The sizing flowsheet is presented as Figure B-1.

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B-2

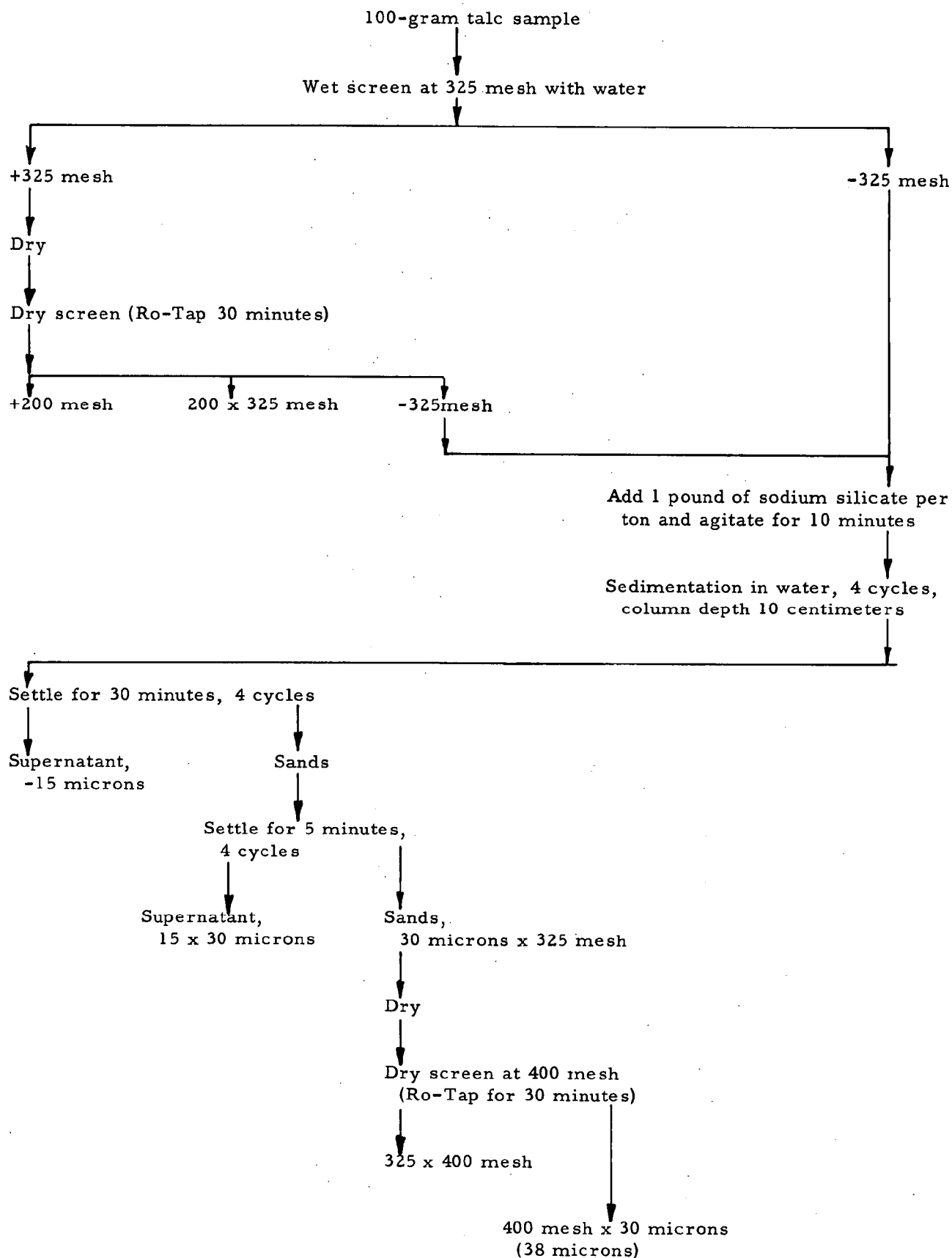
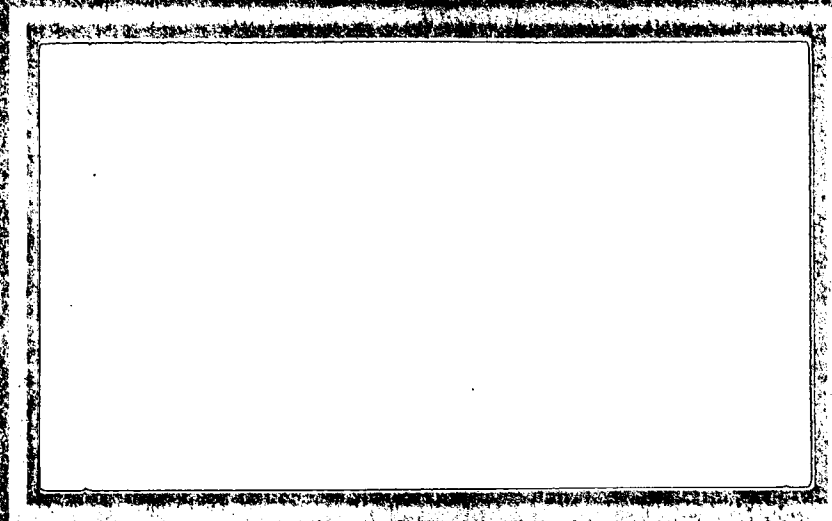
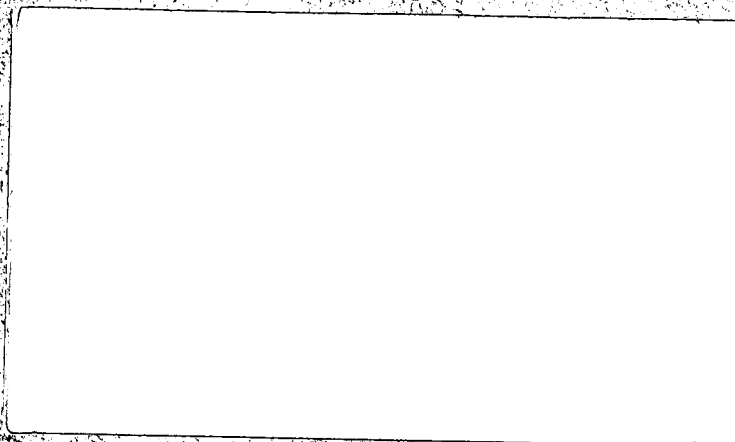


FIGURE B-1. STANDARD FLOWSHEET FOR SIZING OF TALC SAMPLES
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Exhibit 38



PALETTE OF THE FUTURE



PROGRESS REPORT

on

THE PHYSICAL CONCENTRATION
OF TALC ORES — FLOTATION

to

JOHNSON AND JOHNSON

May 23, 1958

by

W. E. Brown, W. L. Smith, and R. D. Macdonald

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio

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5 0 5 K I N G A V E N U E C O L U M B U S I , O H I O

May 28, 1958

Dr. W. H. Lycan
Director of Research
Johnson and Johnson
New Brunswick, New Jersey

Dear Dr. Lycan:

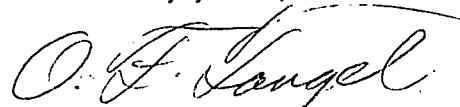
We are transmitting herewith six copies of our Progress Report on "The Physical Concentration of Talc Ores -- Flotation", by W. E. Brown, W. L. Smith, and R. D. Macdonald.

The data in this report show that it is possible to make from Italian No. 2 grade, by flotation, a talc product that is superior to the Italian No. 1 grade. We now have enough laboratory data to design either a pilot plant to produce larger quantities of this material for critical evaluation, or a commercial plant to produce a nominal 50 tons of beneficiated talc per day.

The data in this report indicate that it may be possible to produce a superior talc by flotation from any raw talc which contains an appreciable percentage of platy talc. We do not, however, have enough data as yet to prove this point. Additional experimental work is required to show whether by flotation one can make an acceptable product from other raw materials, such as Indian talc.

After you have reviewed this report, we would be pleased to discuss it with you or to answer any questions which may arise.

Sincerely yours,



O. F. Tangel, Chief
Minerals Beneficiation Division

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PHYSICAL CONCENTRATION OF TALC ORES — FLOTATION

by

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SUMMARY

This report contains data for the physical concentration of talc ores by flotation methods.

Flotation experiments were made on two talc samples from the United States and one from Italy. Most of the tests were made on the Italian talc because it was considered to be of the most immediate importance.

The principal objective of the program was to obtain a product containing a high percentage of platy talc. The results of the tests show that each of the three different samples can be treated to yield a float product that is significantly improved in its content of platy talc. Table 1 summarizes the best results obtained and compares the raw flotation feed with the beneficiated product.

Table 1 shows that both the Oasis and Stone Creek samples were improved in grade. The original Oasis sample contained 48 per cent platy talc and the Float 1 product contained 83 per cent platy talc. The Stone Creek sample contained 30 per cent platy talc and the Float 1 product contained 85 per cent platy talc. Although these flotation products show a substantial improvement in platy-talc content, they lack about 5 per cent of being equivalent to the 88 to 90 per cent platy-talc content of Italian No. 1 grade which is currently being used by Johnson and Johnson as the raw material for baby powder.

Although the desired grade of at least 88 to 90 per cent platy talc was not attained on either the Oasis or Stone Creek samples, a substantial improvement was obtained as the result of relatively few tests. It is expected that a suitable method can be developed, through additional work, to yield a satisfactory product from the Oasis and Stone Creek talcs.

Italian No. 2 talc likewise responded favorably to flotation. Two methods were developed which yielded products that contained 96 to 97 per cent platy talc and 2 to 3 per cent of fibrous talc. Mineralogically, these products are superior to the Italian No. 1 talc which is being used by Johnson and Johnson for baby powder.

The flotation experiments established that the nonplaty talc can be depressed by using the proper amounts of either Dextrin* or hydrochloric acid. When Dextrin was used the froth of the float products was very voluminous and persistent which probably would create handling and filtering problems in full scale operations. When hydrochloric acid was used the character of the froth appeared normal and rapid filtration was obtained.

* Dextrin is made by the hydrolysis of starch and is manufactured by Clinton Foods Incorporated, under the name of Dextrin 603.

TABLE 1. SUMMARY OF FLOTATION RESULTS

Sample	Product	Weight Per Cent of Flotation Feed	Mineral Count, per cent			Effective Reagent
			Platy Talc	Nonplaty Talc	Carbonates	
Oasis	Feed	100.0	48	43	5	---
Oasis	Float 1	34.6	83	16	<1	Dextrin
Stone Creek	Feed	100.0	30	67	1	---
Stone Creek	Float 1	29.9	85	12	1	None
Italian No. 2	Feed	100.0	90	6	3	---
Italian No. 2	Float 1	83.9	96	3	<1	Dextrin
Italian No. 2	Float 1, 2 and scavenger	82.7	97	2	<1	Hydrochloric acid
Italian No. 1	Not treated	100.0	88-90	8-10	<2	---
					Trace	

Note: Italian No. 1 is included for comparison.

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One objection to the use of Dextrin, other than the unsatisfactory frothing properties, would be the possibility of fungus growth on the talc particles if it were not washed out completely or destroyed by heat during the drying operations.

INTRODUCTION

Johnson and Johnson is interested in a broad program which includes investigating the important talc deposits in the world, the measurement of the physical properties of talc, and the physical beneficiation of talc. The purpose of these investigations is to insure Johnson and Johnson of the least expensive and most reliable raw-material source and also to develop methods for further improving the properties of the talc used in baby powder.

At present, Johnson and Johnson is obtaining raw material for baby-powder talcum from Italian deposits. This talc is regarded as very good quality. Some additional improvement in quality is desirable, however, and may be possible by physical beneficiation methods. None of the known domestic talc deposits can compare in quality with the Italian talc, and part of this program is devoted to processing talcs from the more suitable domestic sources in order to obtain a product that is comparable in quality with the Italian talcs.

This Progress Report discusses information obtained on methods of improving the properties of talc. This work is identified on the over-all program being conducted at Battelle as Phase 3 — Physical Concentration of Talc Ores.

The specific objectives of Phase 3 are:

- (1) To obtain a product which consists essentially of talc platelets
- (2) To reject talc particles which are of a size and shape that create unpleasant dusting while dispensing talc from a container
- (3) To obtain a talc product with an obvious sheen in order to convey to the consumer the immediate impression that the talc is of the highest quality.

In addition to achieving the foregoing objectives, it is desirable that the finished product will meet the following specifications.

Moisture: Not more than 0.15 per cent.

Solubility in Hydrochloric Acid: Not more than 6 per cent.

Fineness: Not less than 99.7 per cent through a 100-mesh sieve.
Not less than 98.5 per cent through a 200-mesh sieve.

Microscopic Structure: Shall be platelets, and show no acicular or excessive granular crystals.

Bulk Density: Not less than 22 nor more than 27 pounds per cubic foot, when tested by the Scott Volumeter.

In further keeping with the standards of production, it is desirable that the finished talc product have essentially the same whiteness as that currently being marketed by Johnson and Johnson. Another objective is to reduce the alkalinity of the raw material so that the pH value of a moistened sample will approximate neutrality, or a pH of 7.

Products obtained from physical beneficiation experiments can be evaluated by microscopic examination and other physical measurements. These other physical measurements and their meaning are related to the properties of an accepted standard talcum product. A Progress Report on "Studies of the Physical Properties of Talc, Their Measurement and Comparison", October 15, 1957, by W. L. Smith, has been submitted to Johnson and Johnson on this subject and a second and summarizing one is in preparation.

The only method of physical beneficiation employed so far has been flotation. This is because one of the outstanding properties of talc, from the standpoint of physical beneficiation, is its natural floatability.

This report is composed principally of results from froth-flotation experiments. For this reason a short discussion of the froth-flotation process is included as Appendix B in the hope that it may be helpful in understanding the experiments.

EXPERIMENTAL WORK

Samples Tested

Three samples from separate sources were used for the beneficiation experiments. Two of these are from the United States and one from Italy. These samples have a wide variety of purity with respect to degree of platiness and the contained impurities, and probably are typical of what may be expected in talc deposits of potential interest.

Table 2 shows the composition of these samples as determined by microscopic count.

TABLE 2. MINERALOGICAL COMPOSITION OF SAMPLES INVESTIGATED

Sample	Mineral Count, per cent				Grind
	Platy Talc	Nonplaty Talc	Carbonates	Tremolite	
Oasis Mine (Nevada)	48	43	5	4	Minus 65 mesh (dry)
Stone Creek Mine (Montana)	30	67	1	2	Minus 65 mesh (dry)
Italian No. 2	90	6 (fibrous)	3	1	Minus 200 mesh (as received)
Italian No. 1	88-90	8-10 (fibrous)	<2	Trace	Minus 200 mesh (as received)

The mineral count given in Table 2 is made solely on the basis of incidence. No emphasis is given to the size of the particle encountered in the incidence, so the method of evaluation may at first seem questionable. However, repeated counts made on different fields of the same sample and different samples of the same material give surprisingly consistent percentages, and the percentages of carbonate present agree with chemical determinations of acid solubility. Because of this consistency, the method was accepted as sufficiently accurate for most of the investigations.

Particles in Table 2 which are identified as nonplaty talc may be composed of acicular, fibrous, granular, or cryptocrystalline aggregates of tiny platelets which resemble granules.

Nonplaty talc contained in the Italian samples is mostly fibrous or acicular in form. It is difficult to distinguish acicular talc from remnants of platelets and tremolite in sizes smaller than 10 microns.

Table 2 includes, for comparison, the composition of the Italian No. 1 grade which is the raw material currently used in Johnson and Johnson baby powder. The mineralogical difference between the No. 1 and No. 2 grades is almost insignificant. Italian No. 1 talc, however, costs several dollars more per ton. The Oasis and Stone Creek Mine samples were selected to determine whether talc of a low platy content could be improved sufficiently to compare favorably with the Italian talc and, if so, what recovery might reasonably be expected. Data on the beneficiation of various talcs would provide information that would permit an estimate of the tonnage of material necessary to supply the production requirements of Johnson and Johnson. Information could also be developed for the probable cost of beneficiation.

Ten exploratory experiments were made to observe the general response of the minerals during flotation and to learn the relative complexity of the problem. The summarized results of these experiments were contained in our letter report of January 24, 1958, to Dr. W. H. Lycan.

Sample From the Oasis Mine

The Oasis Mine sample came from Nevada and was supplied by the Sierra Talc and Clay Company. This material was available because it had been previously investigated by Battelle⁽¹⁾ for Johnson and Johnson as a potential raw talc source. The material on hand had been roll-crushed and then ground in a disc pulverizer through 65 mesh.

This sample, which contained about 48 per cent platy talc and 43 per cent granular talc, was selected for part of the investigation specifically because of its intermediate platy-talc content. It was believed that any significant improvement made on the ore would be more readily detected on low-grade materials than on high-grade materials.

Table 3 shows the flotation results obtained from five tests made on the Oasis sample and Table 4 gives the test operating conditions.

The results given in Tables 3 and 4 show that the Oasis talc in Test 1 was floated without any reagents and the platiness of the talc was increased from 48 per cent to 77 per cent. This definitely establishes that platy talc is more readily floated than granular

(1) Battelle Summary Report, February 29, 1956.

TABLE 3. SUMMARY OF FLOTATION RESULTS ON OASIS TALC SAMPLE (MINUS 65 MESH)

Test	Product	Weight Per Cent	Approximate Mineral Count, per cent				Reagents Used
			Platy	Nonplaty	Carbonates	Tremolite	
1	Float 1	32.2	77	20	1	3	None
	Float 2	27.0	45	50	2	3	Dowfroth 200
2	Float 1	32.4	75	24	< 1	< 1	None
	Float 2	36.4	45	45		10	Dowfroth 200
3	Cleaner float	31.6	80	18	1	1	Dowfroth 200
5a	Float 1	34.6	83	16	< 1	1	Dextrin
8	Float 1	26.9	82	15	1	2	Dextrin
	Float 2	56.3	60	35	1	4	
	Flotation feed	100.0	48	43	5	4	

TABLE 4. TEST CONDITIONS USED TO OBTAIN RESULTS ON OASIS TALC SAMPLE

Test	Product	Time, minutes			Pulp pH	Per Cent Solids in Feed	Reagent, pound per ton of flotation feed
		Wetting	Conditioning	Floating			
1	Float 1	10	0	5	8.6	13.0	None
	Float 2	0	0	5			Dowfroth 200, 0.17
2	Float 1	10	0	5	8.6	6.8	None
	Float 2	0	0	5			Dowfroth 200, 0.34
3	Cleaner float	2	10	5		9.0	None
5a	Float 1	5	5	5	8.6	13.0	Dextrin, 0.54
8	Float 1	5	5	5	8.6	13.0	Dextrin, 0.94

talc. The only requirement was agitation and aeration of the pulp. Additional recovery of talc was obtained by using Dowfroth 200 (a frothing and collecting reagent for talc) but the float product was essentially the same quality as the feed. Carbonates in the Float 1 product were reduced from 5 per cent to 1 per cent or less. Tremolite was more difficult to reject although less than 1 per cent was observed in the Float 1 product of Test 2. Tremolite rejection was accomplished by reducing the per cent solids in the flotation feed from 13 per cent to 6.8 per cent. Test 3 was made by refloating the combined Float 1 and Float 2 products of Test 1. This yielded a product which was 80 per cent platy talc and contained 31.6 per cent of the original feed weight.

Because platy talc is more readily floated than nonplaty talc, it was believed that the addition of a talc depressant such as Dextrin might have a selective depressing action on the nonplaty talc forms which had appeared in the Float 1 products. Dextrin was used in Tests 5a and 8, and the results show that Dextrin in the amount of 0.54 pound per ton of flotation-feed solids was effective and helped to produce a Float 1 product that was about 83 per cent platy talc. Dextrin in this amount appeared to be effective in causing a small increase in recovery. In Test 8, the Dextrin added was increased to 0.94 pound per ton of flotation-feed solids. The quality of the Float 1 product was essentially the same as in Test 5a, but the weight recovery decreased to 26.9 per cent compared with 34.6 per cent when the lesser amount of Dextrin was used.

The results of the five tests on the Oasis talc show that although none of the products obtained were mineralogically equivalent to the Italian talc, substantial improvement had been obtained. The best results were obtained from Test 5a which yielded a product containing 83 per cent platy talc. A comparison of the Oasis Float 1 product with the Italian samples is given in Table 5.

TABLE 5. COMPARISON OF OASIS FLOAT 1 WITH ITALIAN NO. 1 AND NO. 2 TALCS

	Weight Per Cent	Mineral Count, per cent				
		Platy Talc	Fibrous Talc	Granular Talc	Carbonates	Tremolite
Test 5a, Float 1	34.6	83	2	14	<1	1
Italian No. 1	100.0	88-90	8-10	0	<2	Trace
Italian No. 2	100.0	90	6	0	3	1

The quality of the Float 1 product approaches that of the Italian No. 1 talc, and it is not unreasonable to expect that an equivalent grade might be developed after further investigations.

The products of Test 8, which gave results of the same order as Test 5a were examined microscopically in considerable detail. Each flotation product was sized on a 200-mesh sieve and the oversize and undersize evaluated. These results are shown in Table 6.

The data given in Table 6 show that in the Float 1 product the plus 200-mesh talc is 61 per cent platy talc but the minus 200-mesh talc is 87 per cent platy talc. It is implied that better over-all results would have been obtained by grinding the Oasis sample all through 200 mesh before floating. This was not tried, and if necessary it can be done at a later stage in the program.

TABLE 6. RESULTS OF MICROSCOPIC EVALUATION OF FLOTATION PRODUCTS FROM OASIS TALC, TEST 8

	Weight Per Cent	Mineral Count, per cent			
		Platy Talc	Nonplaty Talc	Carbonates	Tremolites
<u>Flotation Feed</u>					
-65+200 mesh	30	45	45	4-5	4
-200 mesh	70	49-50	40-43	4-5	3-4
All-200 mesh(a)	100	48	43	4-5	3-4
<u>Float 1</u>					
-65+200 mesh	29	61	37	<1	2
-200 mesh	71	87	10	<1	2
All-200 mesh(a)	(26.9)	82	15	<1	2
<u>Float 2</u>					
-65+200 mesh	50	24	71	1	4
-200 mesh	50	70	25	1	4
All-200 mesh(a)	(56.3)	60	35	1	4
<u>Underflow</u>					
-65+200 mesh	18	20	54	18	8
-200 mesh	82	22	54	15	9
All-200 mesh(a)	(16.8)	25	51	16	8

(a) Some of the plus 200-mesh particles that appear to be nonplaty are actually aggregates of minute platelets which become discrete platelets when ground finer than 200 mesh. A more accurate mineral count is obtained by grinding the entire product and then evaluating with the microscope. In addition to this, a minus 200-mesh product has a narrower range of sizes than a minus 65-mesh product which increases the accuracy of a microscopic count and finally, the minus 200-mesh product has a size range similar to the Italian talcs discussed in detail later in the report.

Sample From the Stone Creek Mine

The Stone Creek mine sample came from Montana and was supplied by the Southern California Minerals Company. This material was available because it also had been previously investigated by Battelle⁽¹⁾ for Johnson and Johnson as a potential raw talc source. The material on hand had been prepared to minus 65-mesh size in the same manner as the Oasis sample.

This sample contained 30 per cent platy talc and 67 per cent nonplaty talc.

Two flotation tests were made, and the results are given in Table 7. Table 8 lists the operating conditions during the tests.

TABLE 7. SUMMARY OF FLOTATION RESULTS ON STONE CREEK TALC SAMPLES (MINUS 65 MESH)

Test	Product	Weight Per Cent	Approximate Mineral Count, per cent			
			Platy	Nonplaty	Carbonates	Tremolite
4	Float 1	29.9	85	12	1	2
	Float 2	13.1	30	60	10	
6	Float 1	25.5	86	10	2	2
	Flotation feed	100.0	30	67	1	2

TABLE 8. TEST CONDITIONS USED TO OBTAIN RESULTS ON STONE CREEK SAMPLE

Test	Product	Time, minutes			Pulp pH	Per Cent Solids in Feed	Reagent, pounds per ton of flotation feed
		Wetting	Conditioning	Floating			
4	Float 1	10	0	3	9.0	13	None
	Float 2	0	0	3			None
6	Float 1	5	5	5	8.8		Dextrin, 0.54 Na ₂ SiO ₃ , 1.08

Test 4 shows that about 30 per cent of the talc is recovered in a float product containing 85 per cent platy talc. No reagents were used, which illustrates again that platy talc is more readily floated than nonplaty talc. Test 6 yielded a float product that contained 86 per cent platy talc and 10 per cent nonplaty talc. Dextrin and sodium silicate were used to reject the nonplaty talc but the effect, from the amounts used, was not pronounced.

The quality of the Float 1 products approaches that of the Italian No. 1 talc which is 85-90 per cent platy talc. Through additional experimentation a method probably can be developed, to treat the Stone Creek talc, which will yield a product of quality equivalent to Italian No. 1 talc.

(1) Battelle Summary Report, February 29, 1956.

Italian No. 2 Talc

Three tests were made on Italian No. 2 talc as part of the exploratory program, and the results are given in Table 9. Tests 10 and 11 were made at 6.8 and 13.0 per cent solids, respectively, using the same reagent combination in each, to determine the weight recovery obtained at low and intermediate per cent of feed solids. The results show that at 6.8 per cent feed solids the weight recovery was 75.3 per cent while at 13.0 per cent solids the weight recovery was 85.9 per cent. Test 12 was made at 13.0 per cent solids, without any reagents, to compare with Test 11. The results show that the Float 1 product was no better than the flotation feed and also only 59.9 per cent of the weight was floated. In Test 10 the froth of the Float 1 product was broken down easily, but in Test 11 the froth was very difficult to break down and filter. Undoubtedly this would present handling difficulties in a plant.

A summary of these results indicates that:

- (1) Better recoveries are possible when using 13.0 per cent feed solids compared with 6.8 per cent feed solids.
- (2) Dextrin is effective in reducing the amount of nonplaty (fibrous) talc in the Float 1 product.
- (3) Dowfroth 200 is needed to obtain good weight recovery.
- (4) The froth of the float products is easy to break down when the per cent feed solids is low. However, the lower per cent feed solids results in a lower yield of Float 1.

Following these exploratory experiments, a program was started to improve the froth characteristics without sacrificing the platiness of the Float 1 product and to maintain or raise the per cent of weight recovery. Forty-four flotation tests were made, all on Italian No. 2 talc.

TABLE 9. SUMMARY OF PRELIMINARY FLOTATION RESULTS ON ITALIAN NO. 2 TALC

Test	Product	Weight Per Cent	Approximate Mineral Count, per cent			
			Platy	Nonplaty	Carbonates	Tremolite
10	Float 1	75.3	96	3	<1	<1
11	Float 1	85.9	96	3	<1	<1
12	Float 1	59.9	89	8	2	1
	Flotation feed	100.0	90	6	3	1

TABLE 10. TEST CONDITIONS USED TO OBTAIN RESULTS OF TESTS 10, 11, and 12

Test	Product	Time, minutes			Pulp pH	Per Cent Solids in Feed	Reagent, pounds per ton of flotation feed
		Wetting	Conditioning	Floating			
10	Float 1	5	5	10	8.7	6.8	Dextrin, 0.94 Dowfroth 200, 0.34
11	Float 1	5	5	10	9.0	13.0	Dextrin, 0.94 Dowfroth 200, 0.34
12	Float 1	10	0	10	8.9	13.0	None

Detailed Flotation Experiments on Italian No. 2 Talc

The methods considered in these tests called for trying various quantities of Dextrin and Dowfroth 200, replacing or supplementing Dextrin with Guartec (a guar gum), using an intermediate per cent of feed solids, stage addition of reagents, regulation of pulp pH during the flotation period, and dewatering and refloating the flotation underflow.

The complete tabulation of these results and the operational data of these tests are given in Appendix A. The more significant information contained in these tests has been abstracted and is given in the following tables.

Table 11 contains the results obtained from experiments relating to the effect that the quantity of frother used has on the amount of talc recovered.

TABLE 11. ITALIAN NO. 2 TALC INFLUENCE OF QUANTITY OF FROTHER ON WEIGHT RECOVERY OF TALC BY FLOTATION

Test	Float Product Weight Recovery, per cent	Dowfroth(a), pounds per ton of feed solids	Character of Froth			Platy Talc, per cent
			Good	Fair	Poor	
36	51.0	None	x			Mostly fines
37	70.4	0.17		x		96
35	83.3	0.34			x	96
35	91.0	0.68			x	94

(a) Chemical composition is discussed in Appendix A.

Each of the tests reported in Table 11 was made at 10 per cent feed solids and included Dextrin⁽¹⁾ in the equivalent amount of 0.47 pound per ton of flotation feed solids. The pH of the pulp was 8.6.

The results of these tests illustrate the natural floatability of the talc and the additional collecting properties of the frother. Test 36 shows that 51.0 per cent of the talc

(1) Chemical composition is discussed in Appendix A.

floats without any frother. The amount of talc floated increases according to the amount of frother added. However, an increase in the amount of frother added resulted in froths more difficult to handle. When 0.34 pound of frother was added, the froth was composed of a large quantity of very fine bubbles that resisted defrothing. Addition of frother in increments of less than 0.17 pound per ton of feed might lead to better froth control, and this can be tried at a later date if suitable results are not obtained by other methods.

Tests 35 and 37 both yielded a float product that was 96 per cent platy talc. However, the recovery of talc was increased from 70.4 in Test 37 up to 83.3 per cent in Test 35 by the addition of twice as much Dowfroth, although the higher recovery was characterized by a less suitable froth.

A series of experiments was made to determine the effect of per cent of solids in the flotation feed on the amount of talc recovered in the float product. The results of these experiments are shown in Table 12.

TABLE 12. ITALIAN NO. 2 TALC INFLUENCE OF FEED PER CENT SOLIDS
ON WEIGHT RECOVERY OF TALC BY FLOTATION

Test	Float Product Weight Recovery, per cent	Feed Solids, per cent	Character of Froth			Platy Talc, per cent
			Good	Fair	Poor	
10	75.3	6.8		x		96
21-24	83.9	13			x	96

In each of these tests the reagents added were Dextrin 0.94 and Dowfroth 0.34 pound per ton of solids. The pH of the pulp was 8.6.

The data of Table 9 show that a higher weight recovery is obtained when a higher per cent of feed solids is employed. At 6.8 per cent solids, 75.3 per cent of the weight is recovered, and of 13 per cent solids, 83.9 per cent of the weight is recovered. This is a substantial difference considering that the same degree of platiness in the float product is obtained by either approach. However, the froth produced from a feed of 13 per cent solids was difficult to handle.

The amount of Dextrin used has a marked influence on the platiness of the talc floated and a slight influence on the weight of talc recovered. Tests that illustrate the magnitude of these factors are given in Table 13.

TABLE 13. ITALIAN NO. 2 TALC INFLUENCE OF QUANTITY OF DEXTRIN
ON WEIGHT RECOVERY OF TALC BY FLOTATION

Test	Float Product Weight Recovery, per cent	Dextrin, pounds per ton of feed solids	Mineral Count		Froth
			Platy Talc, per cent	Fibrous Talc, per cent	
12	81.7	0	89	8	Good
26	82.5	0.16	90	8	Poor
21-24	83.9	0.94	96	3	Poor
Flotation feed	100.0	--	90	6	--

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Each test was made at 13 per cent solids, and 0.34 pound of Dowfroth was added per ton. The pH of the pulp was 8.6.

Data given in Table 13 show that Dextrin has a tendency, although slight, to increase the weight of talc recovered. More significantly, the data show that when no Dextrin was used, the talc floated was only 89 per cent in the platy form, which is essentially the same purity as the flotation feed. When the equivalent of 0.94 pound of Dextrin was added, the float product was 96 per cent platy talc.

It is indicated that Dextrin is not a talc depressant in every sense. More specifically, Dextrin acts as a depressant for nonplaty talc and a mild activator for platy talc. The distinction is not sharp, but it is evident. The separation of platy talc from nonplaty talc may be patentable, and the Battelle Patent Section is conducting a novelty and art search on the subject.

Guartec (trade name of guar gum distributed by General Mills) is also known as a talc depressant and froth modifier. Tests were made with various quantities of Guartec to determine whether it would selectively depress nonplaty talc and also whether any improvement in the quality of the froth might be expected. The summarized results of these tests are given in Table 14.

TABLE 14. ITALIAN NO. 2 TALC INFLUENCE OF QUANTITY OF GUARTEC ON TALC WEIGHT RECOVERY, PLATINESS AND FROTHING PROPERTIES

Test	Guartec, pounds per ton of feed solids	Feed Solids Per Unit	Float Product Weight Recovery, per cent	Platy Talc, per cent	Froth
17	0.47	13	87.6	94	Fair
16	0.94	13	71.0	94	Good
34	0.94	20	77.3	91	Good

In each of the tests reported in Table 14, 0.34 pound of Dowfroth was added, and the initial pH of the pulp was 8.6. No Dextrin was used.

Guartec, in the amounts used, did not aid in producing a float product that was as good as that obtained with Dextrin. When Dextrin was used, a product containing 96 per cent platy talc was obtained, but the best product obtained using Guartec was only 94 per cent platy talc. The type of froth produced with Guartec was much easier to handle, although this is not significant if satisfactory improvement in quality cannot be obtained.

The foregoing discussion describes the most significant data obtained regarding the floatability of talc when Dextrin and Guartec were used. The best results were obtained from Tests 21-24 when 83.9 per cent of the talc was recovered in a float product that was 96 per cent platy talc, 3 per cent fibrous talc, and less than 1 per cent each of dolomite and tremolite. The froth obtained by this method would be difficult to manage.

A comparison of the physical properties of raw Italian No. 1 and No. 2 talcs, and the froth flotation product from No. 2 talc, is made in Table 15.

TABLE 15. COMPARISON OF PHYSICAL PROPERTIES OF RAW AND FLOATED TALC (ITALIAN NO. 1 AND NO. 2)

	Italian No. 1	Italian No. 2	
	Raw	Raw	Floated
Bulk Density, lb per cu ft	23.7	21.5	23.6
Acid Solubility, per cent ^(a)	1.9	2.2	1.2
pH Alkalinity	9.2	8.8	8.7
Relative Lubricity ^(b)	0.935-0.990	0.926	1.017-1.051
Relative Abrasion ^(c)	0.00214	0.00259	0.00132
Weight Per Cent of Raw Talc	100.0	100.0	80-86
Mineral Count, per cent			
Platy Talc	88-90	90	96
Fibrous Talc	9	5	3
Dolomite	<2	3	<1
Tremolite	<1	2	<1

- (a) The figures for acid solubility are at variance with information submitted unofficially in a similar table to Johnson and Johnson by R. D. Macdonald. The acid solubility as shown above is considered accurate, and a description of the method of analysis and the reason for using it will be discussed in a forthcoming report.
- (b) The larger the number, the more lubricious the talc. See Battelle Progress Report to Johnson and Johnson "Studies of the Physical Properties of Talc, Their Measurement and Comparison", by W. L. Smith, October 15, 1957.
- (c) The implication of these numbers will be discussed in a forthcoming report. The more abrasive material produces the highest number.

Table 15 shows that the floated Italian No. 2 talc has a more desirable mineral composition than the raw talc, less acid-soluble constituents (dolomite equivalent), better lubricity, and is about one-half as abrasive.

Although the possibilities of further improvement of quality, recovery, and froth properties were far from exhausted when using Dextrin or Guartec, a different approach seemed advisable for two reasons. First, Dextrin and Guartec, although not toxic, might be objectionable because they are organic compounds that may cause rancidity or fungus growth if not thoroughly removed or destroyed during the process. This, of course, would be undesirable for baby powder. The second reason for a different approach is that a more controllable froth is desirable. In nonmetallic flotation processes, excessive frothing is not uncommon when the operation takes place in pulps having a high pH value. Most of the foregoing tests were made at a pH of about 8.6, and while this is not considered extremely high, investigation of lower pH values appeared to be worth while. In order to lower the pH to approximately neutral, it was decided to use an inorganic acid, such as hydrochloric, and complete the flotation before the acid was neutralized by the dolomite in the pulp and before the pH began to rise noticeably.

A series of tests was made using hydrochloric acid as a pulp modifier with some encouraging results. Data obtained from these experiments are shown in Table 16.

TABLE 16. FLOTATION RESULTS OBTAINED USING HCl AS A PULP MODIFIER AND VARIOUS AMOUNTS OF DOWFROTH AS A TALC COLLECTOR (ITALIAN NO. 2 TALC)

Test	Dowfroth, pounds per ton of feed solids	Feed Solids, per cent	Float Product Weight Recovery, per cent	Platy Talc, per cent	Froth
43-46	None	10	60.2	98	Good
52-55	0.04	10	57.8	98	Good
39	0.11	10	71.1	97	Good
43-46	0.13	10	74.5	97	Good
52-55	0.17	10	76.6	97	Good
41	0.22	10	77.6	95	Fair
40	0.21	10	76.7	94	Poor
50	0.17	13	77.1	96	Good
51	None	3	53.0	97	Good

In each test the equivalent of 0.09 pound of HCl per ton of ore was added, and the pulp pH was about 7.6-7.8. The wetting time before reagent addition was 5 minutes, and the conditioning time with HCl before flotation was 2-3 minutes.

The results given in Table 16 show that a float product containing at least 97 per cent platy talc and having acceptable frothing properties is readily obtained.

Increasing the amount of frother increased the weight recovered, but it was noted during this series of tests that 0.11 pound of Dowfroth was about the maximum that could be added to obtain the Float 1 product without encountering frothing problems. The float products all filtered rapidly but the underflow products filtered slowly. This suggests that the solids in the underflow are much finer than the float products.

The size distributions of the products obtained from Tests 43-46 were determined. These were discussed in a letter report dated April 1, 1958, to Dr. W. H. Lycan. The data show that the flotation feed was 13.5 per cent finer than 4.7 microns but the flotation underflow was 26.7 per cent finer than 4.7 microns. Although the Float 1 product contained only 9.7 per cent of the weight finer than 4.7 microns, it is our belief, as judged from handling of the product, that flotation alone did not remove enough particles of dust-forming size to be acceptable. Elimination of those sizes which create air borne talc particles probably will require a cyclone type of treatment, and a number of experiments are planned to determine what factors are involved and whether hydraulic or pneumatic cyclone treatment is the more feasible.

CONCLUSIONS

Data and observations obtained from the flotation tests to date have established that:

- (1) Platy talc floats more readily than nonplaty talc.
- (2) A frothing agent, such as Dowfroth 200 is helpful in obtaining reasonable talc recovery.

- (3) About 13 per cent solids is the optimum feed pulp density for treating Italian No. 2 talc.
- (4) Either Dextrin or hydrochloric acid is an effective reagent for rejecting nonplaty talc.
- (5) When Dextrin is used to depress nonplaty talc, the froths produced are voluminous and difficult to handle. When hydrochloric acid is used to regulate the pulp pH and depress nonplaty talc, the froths produced are normal and will filter rapidly.
- (6) Italian No. 2 talc can be floated to yield a product which is mineralogically superior to Italian No. 1 talc.
- (7) Oasis and Stone Creek types of ores can be floated to yield products that approximate the quality of Italian No. 1 talc. It is believed that methods can be developed for these types of talc which will yield satisfactory products.
- (8) Flotation will reject some of the objectionable fine talc, but more complete removal of the fines probably will require classification by hydraulic or pneumatic cyclones.

FUTURE WORK

Future experiments would have as an objective a higher recovery of platy talc. Such experiments would be based on the use of hydrochloric acid to control the pulp pH and thereby the rejection of nonplaty talc while using different techniques of frother addition for improved recovery.

Flotation alone does not reject a sufficient amount of the particles which are potential dust; therefore, experiments would be made to remove these sizes by hydraulic cyclones.

After optimum beneficiation conditions have been obtained, it would be planned to produce enough product for various physical measurements and also enough product to send to Johnson and Johnson for their subjective appraisal.

We propose to investigate the feasibility of nearly complete removal of dolomite by leaching the float products with an inorganic acid. Nearly complete removal of dolomite would be necessary if it is important to obtain a talc product having a neutral pH.

Flotation tests would be made on samples of Italian No. 2 talc which represent different lots or shipments in order to establish that the beneficiation process is applicable to any potential differences in source material.

The original notes on the laboratory work described in this report are in Battelle Laboratory Record Book No. 14265, pages 1 to 100, inclusive; and also in Laboratory Record Book No. 14668, pages 1 to 33, inclusive. The work was done in the period from December 11, 1957, to May 12, 1958.

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APPENDIX A

DETAILS OF FLOTATION WORK

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A-1 and A-2

TABLE A-1. DETAILED RESULTS OBTAINED FROM FLOTATION OF ITALIAN NO. 2 TALC

Test	Product	Weight Per Cent	Approximate Mineral Count, per cent				Feed, solids per cent	Flotation Time, min	Reagents Used, pounds per ton of feed					Froth Character			Remarks
			Platy	Nonplaty	Dolo-mite	Tremo-lite			Dextrin	Guartec	HCl	Dowfroth 200	Other	Good	Fair	Poor	
Flotation Feed	Italian No. 2	100.0	90	6	3	1											
11	Float 1	85.9	96	3	<1	<1	13	10	0.94	0	0	0.34	0			x	
12	Float 1	59.9	89	8	2	1	13	10	0	0	0	0	0	x			Same purity as feed
	Float 2	21.8						5	0	0	0	0.34	0		x		
	Float 3	7.3	Not determined					5	0	0	0	0.17	0	x			
13	Float 1	87.2	93	6	1	<1	13	10	0.94	0	0	0.34	0			x	Tap water used to pulp solids
14	Float 1	84.4	Not determined				13	10	0.94	0	0	0	0.34(a)		x		
15	Float 1	64.4	95	4	<1	<1	13	5	0.94	0	0	0.17	0		x		
	Float 2	16.6	92	6	1	1	5	0	0	0	0	0.17	0		x		
16	Float 1	71.0	94	ND	ND	ND	13	5	0	0.94	0	0.34	0	x			Filtered quickly
	Float 2	15.0	Not determined				5	0	0	0	0	0.34	0	x			
17	Float 1	87.6	94	5	<1	<1	13	5	0	0.47	0	0.34	0		x		
	Float 2	7.3	91	6	2	1	5	0	0	0	0	0.34	0	x			Same purity as feed
18	Re-cleaner	36.0	96	3	<1	<1	13	15	0	0.47	0	0.34	0		x		Float 1 refloated twice
19	Cleaner	56.5	Not determined				13	15	0.47	0.11	0	0.34	0			x	Float 1 refloated once
20	Float 1	66.6	Not determined				13	5	0.94	0.61	0	0.34	0		x		
	Float 2	10.7	Not determined				13	5	0.47	0	0	0.17	0	x			
21-24	Float 1	83.9	96	3	<1	<1	13	10	0.94	0	0	0.34	0			x	Duplication of Test 11; average of four tests
25	Discarded because of contamination																
26	Float 1	82.5	90	8	<2	<1	13	10	0.16	0	0	0.34	0			x	
27	Float 1	75.0	Not determined				13	10	0.16	0	0	0.17	0		x		
28-32	Discarded because reagents had deteriorated																
33	Float 1	68.1	92	5	1	2	13	5	0	0.94	0	0.34	0	x			
	Float 2	20.7	87	6	3	4	5	0	0	0	0	0.34	0	x			
34	Float 1	77.3	91	6	2	1	20	5	0	0.94	0	0.34	0	x			
	Float 2	12.9	Not determined														
35	Float 1	83.3	96	2	<1	1	10	10	0.47	0	0	0.34	0			x	
	Float 2	7.7	91	7	1	1	5	0	0	0	0	0.34	0	x			
36	Float 1	51.0	Not determined				10	10	0.47	0	0	0	0	x			Predominantly fine particles
	Float 2	27.6	Not determined				5	0.47	0	0	0	0.34	0	x			Contains coarse-platelets and contaminants
37	Float 1	70.4	96	2	<1	1	10	10	0.47	0	0	0.17	0			x	
	Float 2	16.3	Not determined						0.94	0	0	0.85	0	x			
38	Float 1	83.1	Not determined				10	10				0	0.50(b)	x		x	
39	Float 1	52.5	99	<1	<1	<1	10	ND	0	0	0.9	0	0	x			Exceptionally good grade; at end of test pH of pulp was 7.4
	Float 2	18.6	96	3	<1	<1	ND	0	0	0	0.11	0	0	x			
40	Float 1	76.7	94	4	2	1	10	0	0	0.09	0.21	0	0			x	
41	Float 1	68.3	96	2	<1	1	10	7	0	0	0.09	0.11	0		x		
	Float 2	9.3	93	4	<1	<2	5	0	0	0	0.11	0	0	x			
42	Discarded because of contamination																
43-46	Float 1	60.2	98	1	<1	<1	10	10	0	0	0.09	0	0	x			Filtered rapidly
	Float 2	14.3	96	2	1	1	5	0	0	0	0	0.13	0	x			Filtered rapidly
	Under-flow	25.5	67	21	6	6											pH of pulp was 7.6, filtered slowly
47	Discarded because of contamination																
48	Float 1	58.0	Not determined				10	10	0	0	0	0	0.30(c)	x			Reagent 620 produced buff-colored products
	Float 2	14.2	Not determined				3	0	0	0	0.09	0.11	0	x			
49	Float 1	To be repeated, results questionable						10	0	0	0	0.09	0	0	x		Flotation feed source was obtained from cyclone underflow
	Float 2						5	0	0	0	0	0.13	0	x			
50	Float 1	62.8	97	2	Trace	Trace	13	10	0	0	0.09	0	0	x			
	Float 2	14.3	94	5	<1	1	8	0	0	0	0	0.17	0	x			
51	Float 1	53.0	97	2	<1	<1	3	10	0	0	0.09	0	0	x			
52-55	Float 1	57.8	98	<2	<1	<1	10	5	0	0	0.09	0.04	0	x			
	Float 2	18.8	96	3	<1	<1	5	0	0	0	0	0.13	0	x			
56(a)	Scavenger	6.1	95	3	<1	1	7	10	0.89	0	0	0.13	0.11	0	x		Underflow from Tests Nos. 52-55 was cycloned and cyclone underflow used as flotation feed

Note: Some tests are not evaluated mineralogically because of unsatisfactory froth characteristics or because weight recovery was too low.

Reagents used: Dextrin is made by hydrolysis of starch and manufactured by Clinton Foods Incorporated, under the name of Dextrin 603.

Guartec is the General Mills trade name for guar gum.

HCl is reported as pounds per ton of reagent grade hydrochloric acid which is about 38 per cent of HCl.

Dowfroth 200 is a water-soluble frothing agent manufactured by the Dow Chemical Company. The chemical formula is $\text{CH}_3\text{-CH-CH}_2\text{-O-C}_3\text{H}_6\text{-O-C}_3\text{H}_6\text{-O-CH}_3$.

(a) Dowfroth 250.

(c) Reagent 620.

(b) Ultrawet "K".

(d) Test 56 was made on the underflow product of Tests 52-55, and recovery of 6.1 per cent refers to the original feed for Tests 52-55.

APPENDIX B

FROTH FLOTATION

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B-1

APPENDIX B

FROTH FLOTATION

Froth flotation is a process of material separation for solid particles, usually finer than about 200 microns in size. The separation takes place in an air-water mixture, and is a result of the adhesion of certain particles to air bubbles and the wetting of other particles by the water phase. Whether a particle will adhere to the air phase and be floated, or be wetted by the water phase and sink depends on the character of its surface.

Materials that either ionize or hydrate in water are nonfloaters, and most minerals are in this group. Sulphur, graphite, and talc are exceptions and are called natural floaters. Materials with a hydrocarbon surface, such as solid paraffin, are not wetted by water and will adhere to air bubbles. A material normally water wettable and nonfloatable can be made nonwettable and readily floatable by coating it with a monomolecular film of a paraffin-type chemical (collector), which presents a surface to the air-water mixture essentially the same as solid paraffin. The polar part of the chemical causes the hydrocarbon chain (nonpolar group) to stick to the surface of the mineral.

The reagents employed in flotation, grouped according to their function, are frothers, collectors, and modifiers. In the flotation of talc, however, collectors play no part and are not discussed here because talc has a naturally nonwettable surface.

Frothers

Frothers reduce the surface tension of the water and stabilize the air bubbles. The frother molecule is heteropolar: one part of the molecule has an affinity for water and the other has an affinity for air. The most widely used frothers are pine oils, cresylic acid, and various aliphatic alcohols. Substances with structures similar to alcohols, phenols, ketones, or aldehydes are most suitable, but many other organic compounds are potential frothers.

Frothers usually have only slight collecting properties, that is, they do not adsorb on minerals in such a way as to make the surface nonwettable. Some outstanding exceptions are that certain frothers aid in the collection of talc, graphite, molybdenite, sulphur, and coal, and this fact has been used in the work done on Italian talc.

Modifiers

Modifiers are chemicals which can be used to affect the wettability or nonwettability of a surface. They are used most commonly in connection with collecting reagents, to modify the degree of surface action, so that species of minerals may be separated with greater selectivity. Modifiers also affect the surface characteristics of naturally nonwettable minerals such as talc, and can be used to increase the quantity of talc which will float under a given set of conditions or the quantity of waste material which can be prevented from floating.

B-2

Modifiers usually are inorganic reagents, but some organic ones are used also. Some of the common ones are hydroxides, oxides, silicates, carbonates, and phosphates of sodium or calcium, mineral acids, short-chain organic acids, starch, dextrin, gums, and glues.

Flotation Variables

Every ore contains at least a small quantity of soluble salts, and the water used for milling, regardless of its purity, contains many kinds of ions. This means that every flotation system, before the addition of any reagents, contains literally dozens of ions which are capable of competing for a place on the surface of mineral particles. After the addition of collecting, frothing, and modifying reagents, this situation is further complicated, and when the air is introduced, the oxygen and carbon dioxide of the air take their turn at altering the pulp conditions.

In addition to the chemical variables, there are physical and mechanical variables in a flotation system, such as particle size, water to solid ratio, speed of agitation, flotation time, place of reagent addition, type of machine used, temperature, cell arrangement, and sequence of mineral flotation. The kind and quantity of slime present in a flotation pulp are also factors of importance.

The combination of these chemical, physical, and mechanical variables results in a heterogeneous system of such complexity that it defies the time-honored method of scientific investigation, which is, to change one variable while holding all others constant. The change of any one variable simultaneously changes many others. For example, a change in acidity (pH) by the addition of hydrochloric acid will not only change the concentration of hydrogen, hydroxyl, and chloride ions present in accordance with the laws of mass action, but it may change the concentration of nearly every ion present in the pulp, and any one of these concentrations may be critical to successful flotation. In addition the change in acidity will affect the ability of the frother to produce a stable froth.

Flotation as an Art

It is because of this inherent complexity that flotation is often referred to as an art rather than a science. Successful results on any ore are obtained only by an "artistic balance" of the many variables. Actually, the picture is not so bad as might be supposed, for the majority of the variables usually are of minor importance and only five or ten must be studied closely.

This brief discussion of flotation variables is included to stress the point that each ore presents its own intricate system, and that the set of conditions which gives optimum results for one ore may require modification for another.

Laboratory Flotation Procedure

The flotation equipment used for these experiments is the standard Fagergren Laboratory Flotation Cell of 500 gram solids nominal capacity. It is a batch machine, but it is known that the results obtained with this type of equipment can be translated reasonably well in terms of large-scale continuous commercial operation. The

B A T T E L L E M E M O R I A L I N S T I T U T E

B-3 and B-4

Fagergren cell is made up of a cylindrical glass bowl which will hold about 1.75 liters of pulp. The pulp is agitated by a rotor which is placed concentrically inside a stator, both of which are made up of multiple stainless steel rods in a rotunda configuration. As the rotor spins in the pulp, a partial vacuum is created directly beneath it which draws air through a concentric shaft and discharges it at the bottom of the cell. As the air enters the pulp, it is expelled with great shearing force between the rotor and stator and becomes diffused in the form of minute bubbles in the pulp.

The general laboratory procedure used for the flotation of talc samples was as follows:

Pulverized talc and water were added to the flotation cell in the proportions that would give the desired per cent of solids. The rotor was started and the pulp agitated until the solids were wetted. Selected reagents were then added and the pulp conditioned for a few minutes. The air was turned on and the flotation period started. The mineralized froth which forms on the surface of the pulp was skimmed off with a paddle for a specified time or until no more froth formed. Additional reagents were added, if desired, for increased recovery of talc. During the test, records were kept to show the type of water used, per cent solids, pH, quantity and kind of reagents, time allowed for conditioning and flotation, and other significant observations.

If the froth, or float product, was not of the desired purity, some of the standard methods for improvement were:

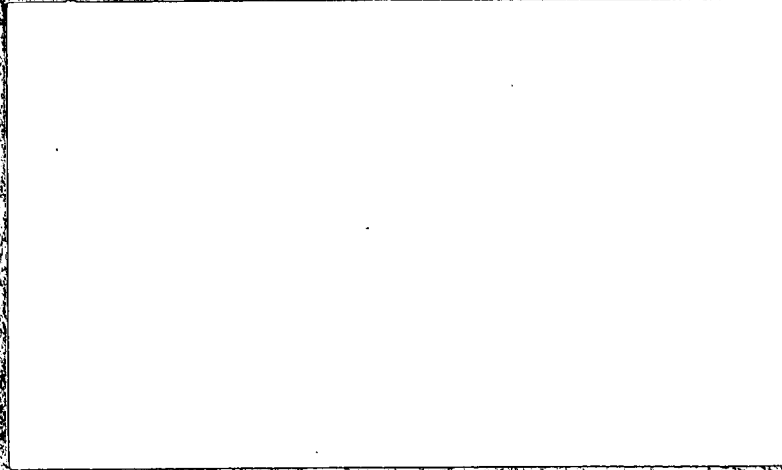
- (1) To decrease the rate of aeration, which decreases the rate of froth overflow
- (2) To decrease the per cent solids in the flotation feed
- (3) To use less powerful frothing reagents
- (4) To use a more effective depressant
- (5) To refloat the froth in a second-stage operation
- (6) To make the separation at another pH level
- (7) To decrease the time of froth collection.

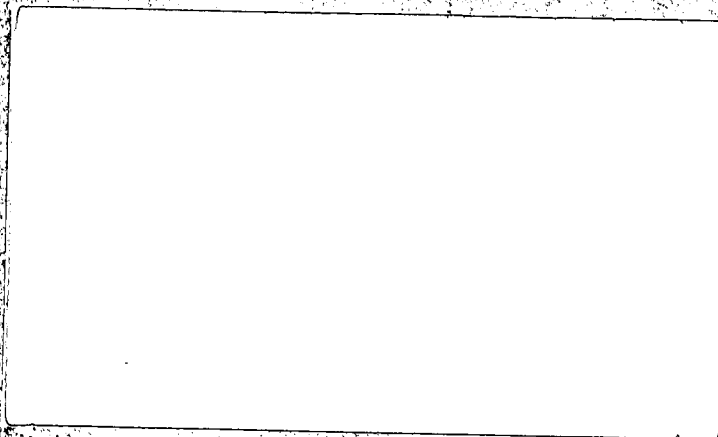
Some of the methods used to increase the recovery of high-grade platy talc were:

- (1) To increase the rate of aeration
- (2) To increase the per cent solids in the pulp
- (3) To dewater the underflow and repeat the test on the unfloated solids and at a relatively high per cent solids.

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Exhibit 39





PROGRESS REPORT

on

THE PHYSICAL CONCENTRATION OF TALC ORES--
FLOTATION OF ITALIAN NO. 2 TALC

to

JOHNSON AND JOHNSON

July 31, 1959

by

W. E. Brown

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio

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Battelle Memorial Institute

S O S K I N G A V E N U E C O L U M B U S I , O H I O

July 31, 1959

Mr. W. H. Ashton
Research Department
Johnson and Johnson
New Brunswick, New Jersey


Dear Mr. Ashton:

We are sending you six copies of our Progress Report, "The Physical Concentration of Talc Ores--Flotation of Italian No. 2 Talc", by W. E. Brown. This report presents most of the data on which our current pilot operation is based. It includes laboratory work done before May 15, 1959. Some additional laboratory data will be given in a later report.

A similar report, concerning the flotation of Italian run-of-mine talc is in preparation. It is planned to include in this report a discussion of flotation factors which are common to both dry-ground and wet-ground talc.

We would be pleased to have your comments on this report.

Sincerely yours,



R. D. Macdonald

RDM:lb
Enc. (6)
cc: Dr. W. H. Lycan
Mr. C. V. Swank

DEDICATED TO THE ADVANCEMENT OF SCIENCE

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APPENDIX

SUMMARIZED RESULTS OF ALL FLOTATION TESTS MADE ON ITALIAN NO. 2 TALC

PROGRESS REPORT

on

THE PHYSICAL CONCENTRATION OF TALC ORES--
FLOTATION OF ITALIAN NO. 2 TALC

to

JOHNSON AND JOHNSON

from

BATTELLE MEMORIAL INSTITUTE

by

W. E. Brown

July 31, 1959

INTRODUCTION

The First Progress Report on the Physical Concentration of Talc Ores--
Flotation was issued to Johnson and Johnson May 23, 1958.

The objectives of the investigations are:

- (1) To obtain a product which consists essentially of talc plate-
lets.
- (2) To reject talc particles which are of a size and shape that
create unpleasant dusting while dispersing talc from a con-
tainer.
- (3) To obtain a talc product with an obvious sheen in order to
convey to the consumer the immediate impression that the talc
is of the highest quality.

In addition to achieving the foregoing objectives, it is desirable
that the finished product will meet the following specifications:

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Moisture: Not more than 0.15 per cent

Solubility in Hydrochloric Acid: Not more than 6 per cent

Fineness: Not less than 99.7 per cent through a 100-mesh sieve
Not less than 98.5 per cent through a 200-mesh sieve

Microscopic Structure: Shall be platelets, and show no acicular or
excessive granular crystals

Bulk Density: Not less than 22 nor more than 27 pounds per cubic foot,
when tested by the Scott Volumeter.

In further keeping with the standards of production, it is desirable that the finished talc product have essentially the same whiteness as that currently being marketed by Johnson and Johnson. Another objective is to reduce the alkalinity of the raw material so that the pH value of a moistened sample will approximate neutrality, or a pH of 7.

The only methods of physical beneficiation employed in work covered in the First Progress Report was flotation. Froth products obtained were 60.2 per cent of the original weight and contained 98 per cent platy talc. The product contained less than 1 per cent each of nonplaty (fibrous) talc, dolomite, and tremolite. A sample of this product was given to Johnson and Johnson, who approved of it and agreed that it was a highly improved talc, and preliminary discussions of a pilot plant were started.

However, the above-mentioned improved talc containing 98 per cent platy talc and having a 60.2 per cent yield contained about 25 per cent of minus 10-micron particles which are potential dust. Although there was an appearance of a refined product, Johnson and Johnson desired to have a talcum powder exhibiting a more pronounced luster.

The future work that was suggested, most of which is covered in this Second Progress Report, included investigations for:

- (1) Increasing the weight recovery of talc without decreasing the quality.

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- (2) Removing dust-forming particles from the finished talc.
- (3) Producing enough improved talc for certain physical properties measurements and also for Johnson and Johnson's subjective appraisal.
- (4) Removing the residual dolomite from the beneficiated product by acid leaching.

During the experimental program discussed in this report, Johnson and Johnson requested that more emphasis be placed on obtaining a product with a high luster and to make supplemental investigations that would provide data as a basis for the design, construction, and operations of a pilot plant.

SUMMARY--ITALIAN NO. 2 TALC

Italian No. 2 talc contains 27.2 per cent of its weight finer than 9.7 microns. This is objectionable because of excessive dust and because the presence of fines is detrimental to good flotation results.

Single-step hydraulic cycloning in a 30-mm-diameter cyclone was effective in removing up to 83.9 per cent of the minus 10-micron size particles.

Data obtained from the experiments showed that ranges of satisfactory results would be obtained depending on operating conditions. Cyclone underflows, which comprise the flotation feed, were obtained containing from 6.5 to 8.1 per cent of the weight finer than 10 microns. The amount of original weight recovered as cyclone underflow varied between 64.7 and 70.6 per cent.

Flotation products containing 97 to 99 per cent of platy talc were obtainable without cycloning. Such products contained almost 25 per cent of their weight finer than 10 microns.

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Flotation products containing 97 to 99 per cent of platy talc were also obtained from a cycloned product. Such products of flotation contained only 6.6 per cent of the weight finer than 10 microns.

Hydrochloric acid added in the correct quantity, between 1.13 and 2.30 pounds per ton of feed solids, was effective in maintaining the purity of finished talc at 97 to 98 per cent platy particles. This amount of acid created a pulp pH ranging between 6.9 and 7.8 during flotation.

Sulphuric acid was not a satisfactory substitute for hydrochloric acid when added in similar amounts and with similar pulp pH levels.

Deionized water, as a talc slurring agent, gave better flotation products than soft or tap water and tap water gave better results than soft water.

Deionized and tap water yielded flotation products containing 97 to 98 per cent platy talc with recoveries approaching 60 per cent of the feed weight. When soft water was used, the Float-1 product was 93 to 95 per cent platy talc and the recoveries dropped to about 40 per cent.

Pulp density of flotation feed is important to froth control and purity of the froth product. Flotation experiments made at feed densities of about 10 per cent solids gave voluminous froths carrying as much as 1.2 per cent of dolomite although the platy content was 97 to 98 per cent. When the pulp density was lowered to about 8 per cent solids, the froth properties were satisfactory and the float product contained only 0.3 per cent of dolomite.

Only completely water-soluble frothers were used in the flotation experiments. The maximum amount of frother which would yield good froth products in the Float-1 step is about 0.08 pound per ton of feed solids. More than this amount creates a troublesome froth and a decrease in platy talc content. Dowfroth 250 is a stronger promoter for flotation of talc than Dowfroth

200, but there is no basis for ranking one over the other without further study.

Flotation products dried at temperatures below 1100 F were not affected by the heat. Above 1100 F the particles began to change to a tan or creamy color and become gritty.

No flotation products were made from Italian No. 2 talc that had what would be classified as high or outstanding luster. Products showing 98 or 99 per cent platy talc frequently did not exhibit much more luster than those which were only 95 or 96 per cent platy talc.

Techniques which Battelle believes are important in maintaining the luster or effecting a slight improvement in luster are:

- (1) Removal of minus 10-micron particles.
- (2) Complete washing of the filter cake to remove dissolved mineral salts and flotation reagents.
- (3) Using deionized water as a slurry agent for the entire process.
- (4) Drying the talc at temperatures below 1100 F.

Removal of the minus 10-micron talc alone will cause the talc to have a refined appearance and although the luster is improved slightly it is not an outstanding feature.

The summarized conclusions are that Italian No. 2 talc was satisfactorily beneficiated in the laboratory to the extent that the results warranted the construction of a pilot plant to establish that the talc could be processed on a continuous basis in a commercial manner.

METHOD OF EVALUATION OF PRODUCTS

Johnson and Johnson, at the outset of the talc beneficiation program, had set as one of the principle objectives the production of a talc product

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consisting essentially of talc platelets. This is because platy talc is nonirritating and imparts a pleasant feeling when applied to the skin. Mineral particles which are acicular, blocky, gritty, or excessively fine impart an unpleasant feel or produce an irritating effect. Unfortunately, this is a subjective evaluation and the relative amount of pleasant or unpleasant feeling will not be the same for all people, particularly when the true differences are relatively slight.

Nontalc particles in a powder, such as dolomite, can be determined accurately by chemical analyses or approximated from a microscope count. Nontalc particles of gritty or abrasive nature can also be assigned relative values by certain measurements obtained from lubricity board^(a) and abrasion pellet tests^(b). However, investigations with the lubricity board and abrasion testing apparatus were not carried far enough to determine whether the information obtained from them is useful in evaluating powders in terms of platy talc versus fibrous talc. At this time, the only satisfactory method of accounting for the proportions of platy talc and fibrous talc in a powder is by making an actual count of the particles observed in the field of a microscope.

A talc sample to be evaluated is dusted onto a glass slide which has been spotted with oil having a refractive index of 1.520. The dust is dispersed in the oil by stirring with a fine probe. The oiled sample is then covered with a glass cover plate and placed in the field of a polarizing microscope with the objectives selected for about 75X.

(a) Battelle Progress Report, Studies of the Physical Properties of Talc, Their Measurement and Comparison, by W. L. Smith, October 15, 1957.

(b) Battelle Progress Report, Further Studies on the Measurement and Correlation of the Physical Properties of Talc, by W. L. Smith, May 9, 1958.

Light is then adjusted to reflect upward through the sample to the eyepiece. The eyepiece having two crosshairs fixed at 90 degrees to each other is focused on the field. Particles which coincide with the crosshairs are counted and classified as platy talc, fibrous talc, dolomite, or tremolite and sometimes accessory minerals.

Statistically, the more particles counted the higher will be the accuracy providing the identifications are accurate and the sampling reliable.

The probably sources of error in counting are:

- (1) Failure to count enough particles
- (2) Sample not representative
- (3) Improper identification of particles
- (4) Personal element of unintentional prejudice arising from the examiners foreknowledge of the approximate quality of the product
- (5) Quality of product being examined.

A discussion of each of these errors follows:

Failure to Count Enough Particles

By trial and comparison, it was established that a minimum of 250 to 300 particles should be counted. Counting less than this amount may give erratic results. An example of an evaluation made on a product in which counts of 300, 600, and 900 particles were made shows:

Number of Particles Counted	Platy Talc Content	
	Direct, per cent	Cumulative, per cent
First 300	98.7	98.7
Second 300	99.7	99.2
Third 300	98.3	98.9

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The foregoing data show a maximum deviation of 1.4 percentage points for individual counts of 300 particles. The amount of platy talc, computed after counting 300 particles was 98.7 per cent and the result of counting 900 particles showed the sample contained 98.9 per cent or a difference of 0.2 per cent from the first 300 count of 98.7 per cent. It would seem from this information that ordinarily a count of 300 particles would be sufficiently accurate when evaluating talc powder of this approximate purity. Acceptable accuracy as related to quality of product examined is discussed in subsequent sections of this report.

Sample Not Representative

All samples to be evaluated should be completely dry to obtain a uniform dispersion in the oil. Also, all samples should be screened at the known limiting size at which the sample had been originally prepared. Finally, the sample should be well mixed so that segregation of sizes is avoided.

Even with these precautions, there will be occasions when sample specimens will appear much different than duplicate specimens of the same sample. This is not always readily explainable and must be guarded against. Usually the person who made the product will spot an anomaly at once and a closer examination is requested on a new specimen.

Improper Identification of Particles

Nearly whole and large platelets are rarely improperly identified. Small particles become more difficult to identify if hurriedly examined. The mineralogy of Italian No. 2 talc is such that most of the nonplaty talc and tremolite are finer than the major part of the powder. Dolomite usually is fine but some relatively large particles do appear. However, dolomite is

quite distinctive and not easily misjudged. Some caution must be used in distinguishing between nonplaty talc, shards of platelets, and transitional talc-tremolite. Occasionally a platy talc particle will be oriented so that the cross section only is visible. When this condition exists, it is easily mistaken as nonplaty talc or tremolite. After the rest of the field has been counted, locate this particle again. Gently tap the glass cover plate with a pencil a few times to see if the particle is on edge and when moved if it will fall over and exhibit a platy surface. At other times, when the light passing through a particle happens to strike at just the right angle, one may get the impression of a piece of fibrous talc when actually the light is only accentuating the edge of a large platelet.

Personal Element in Evaluations

The same bias has been observed here as frequently is encountered in ore sampling. There are some psychological aspects involved which will tend to influence a person's decision when there are choices to be made, especially if the person making the count has a knowledge of the background of the sample. Naturally, the best way to avoid this is to have the sample evaluated by an examiner totally unfamiliar with the source of the sample. This may not always be practicable or desirable because a nonrepresentative sample is quickly spotted by a person who knows its approximate content and who, too, may observe other characteristics such as unusual fineness or coarseness of the whole sample or of certain mineral species.

A comparison of mineral count obtained from three different competent examiners on the same specimen should not differ more than 2 and at the most 3 percentage points of platy content especially when considering materials having a platy content in excess of about 85 to 90 per cent.

Quality of Product Being Examined

Experience has shown that, when the number of particles counted is limited to about 300, the variations in results are smaller for high purity than for low purity products. Samples having a true platy content of 98 per cent may be expected to be counted as high as 99 or as low as 97, rarely 96. Samples having a true platy content of about 40 per cent may be counted as high as 50 and may be as low as 30, unless a very large count is made. Therefore, it would seem advisable that low-quality talc products be evaluated by more than one examiner and perhaps that the amount of particles counted be increased to 1000 or more, using an average of the results as an acceptable count.

The question may arise as to what deviation in count is significant and what range of difference is allowable. To a large degree, this is related to the importance attached to the product being considered. It is almost impossible to determine subjectively whether the particles are 99 per cent platy talc and 1 per cent fibrous talc or whether they are 97 per cent platy talc and 3 per cent nonplaty talc. On the other hand, it is believed possible that some question may arise as to whether 95 per cent platy talc looks and feels as good as 97 or 99 per cent platy talc. It is conceivable that some people could make this distinction by feel and visual appearance. It is rather likely that there would be a visual distinction owing to a decrease in luster.

No physical or objective method has been devised that will make an unquestioned distinction between small differences in platy and nonplaty talc content. The microscope is still accepted as the best means for identification.

In the microscopic evaluation of results given in this report, not much significance has been attached to the difference in products reported as 99, 98, or 97 per cent platy talc. However, a figure of 97 compared with 99 may indicate a trend and be a warning to be observant and thoroughly investigate any changes reported outside of this range. A change in processing technique that yields a product containing 99 per cent talc and which formerly had been reported as 95 or 96 per cent definitely would be classed as significant.

EXPERIMENTAL WORK

Cycloning (Hydraulic Classification)

Johnson and Johnson had expressed a desire that objectionable dust be removed from the talc, although no set specification was given concerning the objectionable size that should be removed.

A few experiments were made by dispensing baby talcum powder from a can into the air. The particles still suspended in the air, a few seconds after dispensing, were collected on a wetted glass microscope slide. The particles were then measured microscopically and found to have a maximum size of about 12 microns. These particles, 12 microns and finer, would be typical of what might be inhaled and cause discomfort. A reference in the cosmetic literature was found which states, "The pore is not wider than 10 microns in diameter." (a). Hence, the particle sizes which could easily be objectionable are finer than about 10 or 12 microns (about 0.0004 inch).

(a) Cosmetics Science and Technology, Edward Sagarin, Editor, Interscience Publishers, Inc., New York, 1957. Chapter "Physiology and Pharmacology of Sweating", page 1194.

In addition to the objection to fine particles from a physiological standpoint, there also is an objection from a mineral processing standpoint. It is generally acknowledged that a large amount of particles finer than 5 or 10 microns make selective flotation difficult. Such particles tend to float nonselectively, promote froths which are difficult to handle, and consume excessive amounts of reagents.

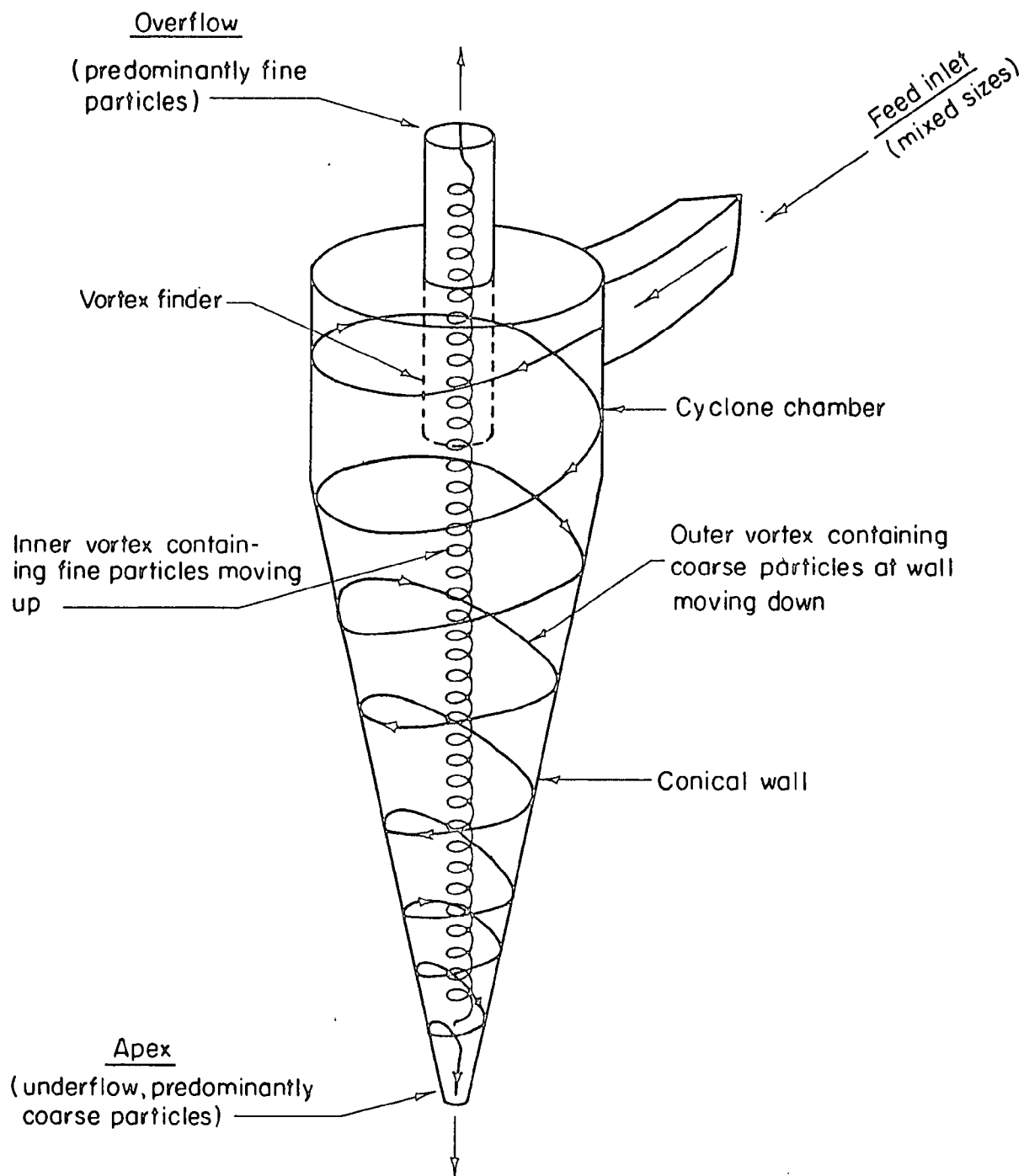
Therefore, the removal of particles finer than about 10 microns would be a distinct advantage from both viewpoints.

Hydraulic cyclones are widely used in the mineral and chemical industry for particle size classification (separation) over a large range of sizes. For the coarser sizes, about 35 mesh, there are other types of classifying devices. For the finer sizes, such as 10 microns and smaller, cyclones are preferred rather than thickeners operated as hydroseparators because the thickeners require extremely large settling areas, water requirements, and capital outlay. Cyclones have high capacity, yield equally good or better classification results, require less water and dispersing agents, and many times less capital outlay than conventional classifiers.

Because of the foregoing reasons, cyclones were selected for classification in these investigations.

Because of the importance of cycloning, in the process developed for talc beneficiation, it is advisable to discuss briefly the characteristics of a cyclone.

Figure 1 is a sketch of a typical cyclone showing the principal parts and the movement of the pulp. The pump, containing the mixed solids which are to be classified by size, is introduced tangentially to the cyclone chamber. The high entrance velocity and centrifugal forces developed form two vortices inside the chamber and conical section. The coarser and heavier particles are



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FIGURE 1. TYPICAL CYCLONE, SHOWING PRINCIPAL PARTS AND
INTERNAL MOVEMENT OF THE PULP

forced to the wall of the chamber and the downward moving vortex, of fluid and solids, is discharged as underflow at the apex. The inner vortex, containing the fine particles, spirals upward along the vertical axis of the cyclone and is discharged as overflow through the vortex finder.

The cyclone is a very simple device but the hydraulic dynamics can be very complex and are beyond the scope of this report.

The diameter of the cyclone probably has the most influence on the size at which the classification is made. The smaller the particle size at which a separation is required, the smaller should be the diameter of the cyclone. For instance, a 3-inch-diameter cyclone may be satisfactory for a 200-mesh separation but a 1-or 2-inch-diameter cyclone may be more suitable for 10-or 15-micron separations. Other factors which influence size of separation are: per cent of solids in the cyclone feed, cyclone inlet and outlet pressures, rate of feed in gallons per minute, and diameter of cyclone apex and vortex orifices.

For the separations desired, it appeared that a 30-millimeter-diameter (1.181 inch) cyclone would be suitable when the right combination of operating conditions were known.

In order to know the amount of material that must be rejected as fines from the cyclone overflow, a sedimentation test was made. The size distribution of Italian No. 2 talc is given in Table 1.

Table 1 shows that 27.2 per cent of the weight of the Italian No. 2 talc is finer than 9.7 microns, most of which should be removed.

TABLE 1. SIZE DISTRIBUTION OF ITALIAN NO. 2 TALC

Equivalent Spherical Particle Diameter, microns	Weight Per Cent Finer Than Particle Diameter
31.4	77.2
13.9	39.8
9.7	27.2
6.7	18.9
4.7	13.5
3.9	11.1
2.9	8.3
2.4	7.0
1.3	3.5

There are no commercial classifiers that make a "hair-line" cut-off on size separations. Cyclones probably are as efficient as other devices; but in practice, as the removal of any given size approaches 100 per cent some of the neighboring sizes will also be removed. On the other hand, cyclones can usually be adjusted so that the overflow is nearly 100 per cent finer than a given size, but a significant amount of that same size will be found in the cyclone underflow.

Therefore, the operating conditions for the cyclone, without involved cycloning by stages in closed circuits, require adjustment of the equipment to overflow several per cent more than the theoretical 27.2 per cent. As mentioned above, this necessitates the loss of some talc particles larger than 10 microns.

A number of experiments were made using a 30-mm-diameter laboratory glass cyclone. The effect of different operating conditions on cyclone performance were investigated. The conditions investigated were:

Effect of diameter of cyclone vortex
Effect of per cent solids in the cyclone feed.

Table 2 shows results of three cyclone experiments which give preliminary information for changes in operating conditions that were needed to obtain the desired particle size classification.

TABLE 2. PRELIMINARY CYCLONE TESTS USING A VORTEX
FINDER DIAMETER OF 4.1 mm

	Distribution, per cent		Per Cent Solids in Product	Flow Rate, gpm
	Pulp Volume	Solids Weight		
<u>Test C-8</u>				
Overflow	68.0	13.4	1.0	1.1
Underflow	32.0	86.6	12.5	0.5
Total Feed	100.0	100.0	4.9	1.6
<u>Test C-9</u>				
Overflow	67.4	18.6	2.7	1.1
Underflow	32.6	81.4	21.5	0.6
Total Feed	100.0	100.0	9.4	1.7
<u>Test C-10</u>				
Overflow	67.3	21.7	4.7	1.1
Underflow	32.7	78.3	29.6	0.6
Total Feed	100.0	100.0	13.8	1.7
<u>Test Conditions:</u>				
Cyclone diameter	30 mm			
Feed inlet diameter	6.0 mm			
Vortex finder diameter	4.1 mm			
Apex diameter	2.9 mm			
Feed pressure	14.7 psi			

Tests C-8, C-9, and C-10 show that the weight of the fine solids rejected in the cyclone overflow reached a maximum of 21.7 per cent when the feed density was 13.7 per cent solids. It was shown previously by sedimentation that at least 27 per cent of the weight must be removed to obtain the desired separation. Therefore, none of the operating conditions were suitable

for near-complete fines rejection. As the per cent solids in the feed increased, the per cent of weight reporting to the overflow increased. The data from the tests indicate that the desired weight directed to the overflow could be obtained by increasing the per cent solids in the feed. Ordinarily this would accomplish the objective. However, when particle size classifications in the 10-micron size range are being attempted, it is advisable to operate with the per cent feed solids as low as is practicable. As the per cent of feed solids is increased the sharpness of separation decreases rapidly. The tendency is for oversize particles to be crowded into the overflow and undersize particles to be forced into the underflow. Therefore, it is better to change some other conditions, if possible. Increasing the vortex finder diameter in the overflow will accomplish the same purpose and usually improve the properties of the underflow.

In the experiments shown in Table 2, the cyclone vortex finder diameter was 4.1 mm. It appeared that a larger diameter vortex finder would yield the desired results, if all other conditions were held constant. A vortex diameter of 6.1 mm was installed in the cyclone and Tests C-11, C-12, and C-13 were made at different feed densities. The results are given in Table 3.

The data in Table 3 show that the increased vortex finder diameter was a step in the right direction. At 4.9 per cent solids in the feed (Test C-11) the cyclone overflow contained 23.0 per cent of the feed weight compared with only 13.4 per cent when the 4.1 mm vortex finder was used. The overflow of Test C-12 contained 30.6 per cent of the weight of the feed, which is about the proper weight. Examination of this product with the microscope showed that although most of the minus 10-micron talc had been removed, a significant amount still remained. A larger diameter vortex finder appeared advisable to

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obtain a cyclone underflow product containing fewer particles in the minus 10-micron sizes.

TABLE 3. CYCLONE TESTS USING A VORTEX FINDER
DIAMETER OF 6.1 mm

	Distribution, per cent		Per Cent Solids in Product	Flow Rate, gpm
	Pulp Volume	Solids Weight		
<u>Test C-11</u>				
Overflow	88.9	23.0	1.3	1.7
Underflow	11.1	77.0	28.3	0.2
Total Feed	100.0	100.0	4.9	1.9
<u>Test C-12</u>				
Overflow	86.5	30.6	3.5	1.7
Underflow	13.5	69.4	38.9	0.3
Total Feed	100.0	100.0	9.4	2.0
<u>Test C-13</u>				
Overflow	84.4	39.5	6.7	1.7
Underflow	15.6	60.5	42.7	0.3
Total Feed	100.0	100.0	13.7	2.0
<u>Test Conditions:</u>				
Cyclone diameter	30 mm			
Feed inlet diameter	6.0 mm			
Vortex finder diameter	6.1 mm.			
Apex diameter	2.9 mm			
Feed pressure	14.7 psi			

Tests C-14, C-15, and C-16 were made using a cyclone with a vortex finder diameter of 8.4 mm. Results of these experiments are in Table 4. Test C-14 shows that the overflow product contains 36.5 per cent of the weight of the cyclone feed. Overflow products obtained from Test C-15 and C-16 contained too much weight and, therefore, must contain an excessive amount of particles larger than 10 microns.

TABLE 4. CYCLONE TESTS USING A VORTEX
DIAMETER OF 8.4 mm

	Distribution, per cent		Per Cent Solids in Product	Flow Rate, gpm
	Pulp Volume	Solids Weight		
<u>Test C-14.</u>				
Overflow	93.2	32.6	2.0	2.2
Underflow	6.8	67.4	35.1	0.2
Total Feed	100.0	100.0	4.8	2.4
<u>Test C-15</u>				
Overflow	91.5	47.2	4.9	2.1
Underflow	8.5	52.8	44.4	0.2
Total Feed	100.0	100.0	9.3	2.3
<u>Test C-16</u>				
Overflow	90.0	57.8	9.1	2.1
Underflow	10.0	42.2	45.0	0.2
Total Feed	100.0	100.0	13.7	2.3
<u>Test Conditions:</u>				
Cyclone diameter		30 mm		
Feed inlet diameter		6.0 mm		
Vortex finder diameter		8.4 mm		
Apex diameter		2.9 mm		
Feed pressure		14.7 psi		

The overflow and underflow products of Test C-14 were examined microscopically and found to be relatively free of misplaced particles.

A sedimentation fractionation of the products of Test C-14 was made and the results are given in Table 5.

TABLE 5. SEDIMENTATION AT 10-MICRON PARTICLE SIZE ON
PRODUCTS OF CYCLONE TEST C-14

Particle Size in Product	Weight Per Cent in Product	Weight Per Cent of Cyclone Feed
<u>Cyclone Overflow</u>		
+10 Micron	29.3	9.6
-10 Micron	70.7	23.0
Total	100.0	32.6
<u>Cyclone Underflow</u>		
+10 Micron	93.4	63.0
-10 Micron	6.6	4.4
Total	100.0	67.4

The data given in Table 5 show that the cyclone underflow contained 67.4 per cent of the weight of the cyclone feed and that the underflow had only 6.6 per cent of particles finer than 10 microns. The original Italian No. 2 talc sample, which is the same as the cyclone feed, contained 27.2 per cent of the weight in particles 10 microns and finer. From a classification standpoint, the cyclone underflow product is nearly perfect. The cyclone overflow had 29.3 per cent of the weight of the particles larger than 10 microns, or 9.6 per cent of all the plus 10-micron particles in the original feed. It also contained 83.9 per cent of the minus 10-micron particles in the original feed.

The cyclone products were evaluated with the microscope to determine the mineral composition. These results are given in Table 6.

TABLE 6. MINERAL COMPOSITION OF TEST C-14 CYCLONE PRODUCTS

Cyclone Product	Weight Per Cent	Mineral Count, per cent				Mineral Distribution, per cent			
		Platy	Nonplaty	Dolomite	Tremolite	Platy	Nonplaty	Dolomite	Tremolite
Overflow	32.6	79	15	5	1	29	79	58	33
Underflow	67.4	95	2	2	1	71	21	42	67
Feed	100.0	90	6	3	1	100	100	100	100

It is shown in Table 6 that the cyclone overflow was composed of 79 per cent platelets. In Table 5, it is shown that 29.3 per cent of this product is larger than 10 microns. Therefore, the total loss of useful plates represents about $(32.6 \times .79 \times .293 = 8.46)$ 8.5 per cent. Said in another way, if all the plus 10-micron platelets had been recovered, the cyclone underflow would represent $67.4 + 8.5 = 75.9$ per cent of the feed weight.

Another important result shown in Table 6 is that the cyclone underflow product contained 95 per cent platy talc compared with 90 per cent in the feed. The mineral distribution shows that cycloning rejected 79 per cent of all the nonplaty talc.

In summation, the cyclone underflow was 95 per cent platy talc and contained only 6.6 per cent of particles finer than 10 microns. This should be an ideal feed for flotation.

Because of the impending pilot plant, it was necessary to discuss with the cyclone manufacturers (Dorr-Oliver Inc.) what equipment was available and if the equipment would be suitable for particle size classification in the minus 10-micron size range. Cyclones were available in the 30-mm-diameter size, but the manufacturer was not able to provide the vortex finder

and apex with diameters of the same dimensions as used in the C-14 test. It was believed, however, that the equipment available would give classification results in the same order and with some advantages. The cyclones available had a vortex finder diameter of 11 mm and an apex diameter of 5.5 mm. Such dimensions would provide increased cyclone capacity and lessen the possibility of oversize material plugging the apex outlet.

The laboratory glass cyclone was fitted with outlets of the same dimensions as Dorr-Oliver could provide and experiments were made for comparative purposes. These results are given in Table 7.

Table 7 shows that the size distribution of the underflow products was essentially the same when the apex diameter was increased from 2.9 to 5.5 mm. Both underflow products contained about 6.5 per cent of minus 10-micron particles. Increasing the diameter of the vortex finder resulted in the loss of more of the plus 10-micron particles in the overflow as the total amount of plus 10-micron increased from 9.6 to 12.1 per cent. In order to decrease this loss, the feed pressure was raised from 14.7 psig to 23 psig, as shown in Test C-127. The results show that the increased pressure lowered the amount of plus 10-micron material in the overflow from 12.1 to 7.7 per cent. However, the fines reporting to the underflow were increased from 6.5 to 8.1 per cent.

Flotation experiments were made on cyclone underflow products from each of the different test conditions reported in Table 7. The results of these flotation tests are discussed in the following flotation section.

The over-all results of the cyclone experiments show that it was possible to treat the original Italian No. 2 talc in a cyclone and obtain a product containing only about 6.5 per cent of minus 10-micron particles. About 10 to 12 per cent of the plus 10-micron material is lost to the overflow. Increasing the cyclone pressure recovered some of the plus 10-micron talc but was accompanied by more of the objectionable minus 10-micron talc reporting to the underflow.

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TABLE 7. COMPARISON OF CYCLONE PRODUCTS SHOWING EFFECT OBTAINED WITH DIFFERENT DIAMETER OUTLETS AND INCREASED FEED PRESSURE

Particle Size in Cyclone Product	Test C-14		Test C-135		Test C-127	
	Weight Per Cent in Product	Weight Per Cent of Feed	Weight Per Cent in Product	Weight Per Cent of Feed	Weight Per Cent in Product	Weight Per Cent of Feed
Overflow						
+10 Micron	29.3	9.6	34.3	12.1	26.1	7.7
-10 Micron	70.7	23.0	65.7	23.2	73.9	21.7
Total	100.0	32.6	100.0	35.3	100.0	29.4
Underflow						
+10 Micron	93.4	63.0	93.5	60.5	91.9	64.9
-10 Micron	6.6	4.4	6.5	4.2	8.1	5.7
Total	100.0	67.4	100.0	64.7	100.0	70.6
Test Conditions:						
Cyclone diameter, mm	30			30		30
Cyclone inlet diameter, mm	6			6		6
Cyclone vortex finder diameter, mm	8.4			11		11
Cyclone apex diameter, mm	2.9			5.5		5.5
Feed pressure, psig	14.7			14.7		23
Feed rate, gpm	2.4			2.7		3.3

B A T T E L L E M E M O R I A L I N S T I T U T E

Flotation

At the close of the experimental program covered in the Progress Report of May 23, 1958, a simple method of processing the talc had been developed that yielded a flotation product containing 98 per cent or more of platy talc.

This method, first reported in Test 39^(a), consisted of briefly conditioning the Italian No. 2 talc with 0.9 pound of hydrochloric acid per ton of feed and making a Float-1 product containing 99 per cent platy talc. A small amount of frother (0.11 pound per ton of feed) was then added and a Float-2 product was made containing 96 per cent platy talc. The two products combined contained 71.1 per cent of the original feed weight and 98 per cent platy talc. The pH of the pulp during Float-1 was 7.4 and the feed pulp was about 10 per cent solids. A total flotation time of 15 minutes, plus 7 minutes for wetting and conditioning, was used. The unmanageable froth, prevalent in all previous experiments, was not quite as noticeable.

Before Test 39 was made, all froths were overly voluminous and 96 per cent platy talc was the best that had been obtained. The flotation methods had consisted of the addition of various amounts of Dextrine or Guartec as depressants for nonplaty and/or fine talc. Both of these reagents are subject to bacteriological decay, forming objectionable mould and fungus, and if not completely removed sometime after the flotation step, they might create an unpleasant odor and appearance to the finished talc. Hence, another type of reagent seemed necessary.

(a) See First Progress Report, Appendix A.

Hydrochloric acid was selected because it offered the following possible advantages:

- (1) It would permit pH control during flotation.
- (2) It would, to some extent, solubilize and loosen carbonate particles which may be coating talc particles.
- (3) HCl forms no insoluble salts which could enter the froth product as by-product contaminants.
- (4) HCl is inorganic and not subject to decay.
- (5) HCl does not produce an objectionable odor.
- (6) HCl does not contribute objectionable color.
- (7) Salts of the reacting acid are easily washed out in a filtration step.
- (8) HCl should aid in solubilizing and wetting the dolomite particles to promote their exclusion from the froth.

The Float-1 product from Test 39, although highly improved mineralogically, contained too much fine talc to be fully acceptable. Tests 43 to 46, inclusive, were made, all in the same manner, to provide enough weight of products for a more thorough examination, particularly of particle size distribution. Flotation results are given in Table 8 with the test conditions.

The data in Table 8 show essentially the same results as in Test 39 except that the weight recovery in Float-1 plus Float-2 is 74.5 per cent as compared with 71.1 in Test 39.

TABLE 8. FLOTATION RESULTS OF TESTS 43-46

Product	Weight Per Cent	Mineral Count, per cent			
		Platy	Nonplaty	Dolomite	Tremolite
Float-1	60.2	98	1	0.7	<1
Float-2	14.3	96	2	1.4	1
Underflow	25.5	67	21	6.0	6
Total	100.0	90	6	2	2
Feed	100.0	90	6	3	1

Flotation Test Conditions

Operation	Reagents Added, lb/ton of feed		Time, min	Solids Per Cent	pH	Water
	HCl	Dowfroth 200				
Wetting	0	0	5	20		
Conditioner	0.09	0	2	10.3	7.6	Distilled
Float-1	0	0	10	10.3	7.8	Distilled
Float-2	0	0.13	5	--	7.6	Distilled

Note: Float-1

Bulk Density 23.7 lb/ft³
 pH 8.7
 +200 Mesh 2 per cent

All the products from Tests 43 to 46, inclusive, were treated by sedimentation to determine the particle size distribution. These results are given in Table 9.

Table 9 shows that the flotation feed and the Float-1 product are similar to particle size distribution down to about 6.7 microns. Below this size more of the fine particles show up in greater percentages in the underflow product. In the column titled Distribution of Sizes, it is seen that 33.6 per cent of all the minus 6.7 plus 4.7-micron particles are in the underflow, 45.8 per cent of all the minus 4.7 plus 3.9-micron particles are in the underflow, and so on. This high rejection of the fine particles to the underflow and out of the froth undoubtedly accounts for the less voluminous froth and hence the higher grade product.

TABLE 9. SIZE DISTRIBUTION OF FLOTATION TEST PRODUCTS OBTAINED BY FLOTATION WITHOUT PRIOR CYCLONING FOR REMOVAL OF FINES (-10 MICRON PARTICLES)

Particle Size, microns	Flotation Feed, weight per cent		Float-1, weight per cent		Float-2, weight per cent		Underflow, weight per cent		Distribution of Sizes, per cent	
	In	Cumulative	In	Cumulative	In	Cumulative	In	Cumulative	Float-1	Float-2
+31.4	22.8	22.8	24.8	24.8	20.0	20.0	14.3	14.3	69.6	13.3
-31.4+13.9	37.3	60.1	37.5	62.3	33.5	53.5	28.4	42.7	65.3	13.8
-13.9+9.7	12.7	72.8	13.2	75.5	15.7	69.2	13.5	56.2	57.8	16.4
-9.7+6.7	8.3	81.1	10.1	85.6	9.6	78.8	9.4	65.6	61.7	13.9
-6.7+4.7	5.4	86.5	4.7	90.3	7.3	86.1	7.7	73.3	48.6	17.8
-4.7+3.9	2.4	88.9	1.1	91.4	2.2	88.3	3.2	76.5	36.9	17.3
-3.9+2.9	2.8	91.7	2.5	93.9	3.1	91.4	4.7	81.2	48.9	13.7
-2.9+2.4	1.3	93.0	1.6	95.5	1.3	92.7	2.1	83.3	56.8	11.2
-2.4+1.3	3.5	96.5	1.6	97.1	3.5	96.2	7.1	90.4	29.4	15.3
-1.3	3.5	100.0	2.9	100.0	3.8	100.0	9.6	100.0	36.9	11.4
Total	100.0		100.0		100.0		100.0			
Per Cent Weight of Total	100.0		60.2		14.3		25.5			

Note: These data obtained from Tests 43-46 using HCl and Dowfroth 200 as the only reagents. (See also Table 8.)

Although this was an encouraging development, the Float-1 product was only 75.5 per cent coarser than 9.7 microns, which also means that it contained 24.5 per cent of particles finer than 9.7 microns, and this is much too fine, as was suspected.

At this point, it was known that it was possible to obtain an improved talc by a relatively simple process. A pilot plant could be designed to process the ore but complete data were lacking that would give the information for obtaining optimum results consistently.

More information was required on what improvements were possible by modifying the process and also what unfavorable results might appear if the modifications exceeded certain limits. The following subjects were investigated to obtain the data for the most efficient plant design and operation:

- (1) Results obtained when fines were removed after flotation
- (2) Results obtained when fines were removed before flotation
- (3) Effect of the amount of HCl added in flotation
- (4) Comparison of HCl with H_2SO_4 as flotation reagents
- (5) Effect of different types of water on quality and recovery of finished product
- (6) Effect of pulp density on quality and recovery of finished product
- (7) Effect of amount and type of frother added.

Results Obtained When Fines Were Removed After Flotation

Although a method for increasing the platy talc content was known, the finished float product still contained 24.5 per cent of fine talc. The logical method of removing the fines was by hydraulic classification or

cycloning. Flotation Tests 52-55^(a) were made to prepare enough froth product for cycloning.

Float-1 and 2 of Tests 52-55 were combined and given two stages of cyclone treatment. The resulting product was examined microscopically, and it was obvious that the minus 10-micron size particles had not been sufficiently removed.

The reason for incomplete removal of the fines is not certain, and although it is probable that a prolonged investigation would lead to a satisfactory method of classification this approach was discontinued. A more direct approach was decided upon which consisted of cycloning to remove the fines before flotation.

Results Obtained When Fines Were Removed Before Flotation

A sample of Italian No. 2 talc was cycloned according to Test C-12 procedure (Table 3) and the cyclone underflow was used as the feed for flotation Test 58.

The Float-1 product contained 98 per cent platy talc and 51.0 per cent of the weight of the flotation feed.

Over-all results of cycloning and flotation are given in Table 10, including the flotation conditions.

Table 10 shows that 51.0 per cent of the weight of the flotation feed was recovered in a product that was 98 per cent platy talc. However, it was only 35.4 per cent of the weight of the original ore (cyclone feed).

Examination of the Float-1 product subjectively by hand, and under the microscope, showed that, although improved in quality, it still contained

(a) See First Progress Report, Appendix A.

TABLE 10. RESULTS OBTAINED WHEN FINES ARE REMOVED BEFORE FLOTATION

Cyclone*	Weight		Mineral Count, per cent	Remarks
	Per Cent in Test	Per Cent of Original Ore		
	Platy Nonplaty Dolomite Tremolite			
Overflow	30.6	30.6	Largely fine, acicular particles	
Underflow	69.4	69.4		
Total	100.0	100.0		
Feed				
			Not determined	
			92	1
			90	3
			6	1
			Not determined	
			98	1
			Not determined	
			Not determined	
			92	1
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			4	
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			Not determined	
			Not determined	
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*** C-12, Table 3.**

an excess of dust-forming particles. However, it was much improved over any product made up to that time. A sample of the Float-1 product was given to Dr. W. H. Lycan in May, 1958, at a conference with Messers. R. D. Macdonald and O. F. Tangel of Battelle. It was agreed that the Float-1 product was superior in quality to that being marketed by Johnson and Johnson at that time.

Further improvement in over-all cyclone and flotation results, by a more efficient rejection of fines, was necessary. This was obtained by revising the cyclone procedure to conform to the method of cycloning described as C-14 procedure, which is reported in Table 7, and floating the cyclone underflow. Tests 63 to 66, inclusive, were made in this manner and the complete results are given in Table 11. Examination of the flotation underflow showed that there was valuable talc which had not been recovered. This product was treated by a scavenger cyclone and the underflow was given a scavenger float. In other words, the original flotation underflow was reprocessed as would be done in a continuous operation.

Table 11 gives the results of the complete processing and represents what could reasonably be expected from a pilot-plant operation. Test conditions are given in Table 11a.

In the summary given in Table 11, it is seen that by combining the Float-1 and Float-2 with the scavenger float product, an improved talc which is 97 per cent platy was obtained in 59.6 per cent of the original weight of the ore.

The pilot plant now being erected was designed principally from data developed from these combinations of experiments. The final flowsheet of the pilot plant incorporates optional circuits which may permit a slight improvement in quality of finished product by retreating the Float-2 and scavenger float products.

TABLE 11. RESULTS OBTAINED FROM TESTS 63-66 USING COMBINED CYCLONING AND FLOTATION INCLUDING A SCAVENGER TREATMENT FOR ADDITIONAL RECOVERY

Product	Distribution of Weight, per cent		Mineral Count, per cent			Remarks
	In Process	Of Original Ore	Platy	Nonplaty	Dolomite Tremolite	
Original Ore	100.0	100.0	90	6	3	1
Cyclone						
Overflow(a)	32.6	32.6	79	15	5	1
Underflow	67.4	67.4	95	2	2	1
Total	100.0	100.0	90	6	3	1
Flotation						
Float-1	54.9	37.0	98	1	0.5(b)	<1
Float-2	24.6	16.6	97	<2	0.9(b)	<1
Underflow(a)	20.5	13.8	85	4	8.3(b)	2
Total	100.0	67.4	95	2	2.2	1
Scavenger Cyclone						
Overflow(a)	17.6	2.4	74	15	5	6
Underflow	82.4	11.4	87	3	2	1
Total	100.0	13.8	85	4	8.3	2
Scavenger Flotation						
Float	53.0	6.0	95	3	<1	<1
Underflow(a)	47.0	5.4	77	4	18	1
Total	100.0	11.4	87	3	9	1
Summary						
Float Products						
Float-1	54.9	37.0	98	1	0.5(b)	<1
Float-2	24.6	16.6	97	<2	0.9(b)	<1
Scavenger Float	53.0	6.0	95	3	<1	<1
Composite		59.6	97	<2	<1	<1

(a) Mineral count is calculated from material balance.

(b) Dolomite content was determined by chemical analysis for CO₂ and converting to MgCa(CO₃)₂.

TABLE 11a. TEST CONDITIONS USED TO OBTAIN RESULTS GIVEN IN TABLE 11

Cycloning	Test C-14	Test C-17
Cyclone Diameter, mm	30	30
Cyclone Feed Inlet, mm	6	6
Cyclone Vortex Finder, mm	8.4	8.4
Cyclone Apex, mm	2.9	2.9
Feed, per cent solids	4.9	1.0
Feed Pressure, psi	14.7	14.7
Feed, Flow Rate, gpm	2.4	2.4
	Tests 63-66	Test 77C17
Flotation		
Feed, per cent solids		
pH during Float-1	8.3	8.1
pH during Float-2	7.6	8.4
HCl Added for Float-1, lb/ton of flotation feed	7.8	Not determined
Dowfroth 200 Added, lb/ton of flotation feed	1.75	0
Float-1		
Float-2	0.07	0.17
Flotation Time, minutes	0.28	Float-2 not made
Float-1		
Float-2	5	5
		Float-2 not made

Effect of the Amount of HCl Added in Flotation

Tests 58, 59, 60, 78, and 79 in Table 12 are presented to compare the results obtained by changing the amount of hydrochloric acid used in the tests.

Data given in Table 12 show that, with HCl additions up to 2.3 pounds per ton of feed, the Float-1 product contains not less than 97 or 98 per cent platy talc. When 6.82 pounds of HCl was added, the Float-1 product dropped to 95 per cent platy talc and the weight per cent recovered was only 46.6 per cent (Test 60).

Tests 78 and 79 show that the Float-1 products contained about 97 to 98 per cent platy talc with a weight recovery of about 59 to 60 per cent. Hydrochloric acid up to 2.3 pounds per ton of feed would appear to be justified only if it were effective in inhibiting the inclusion of fine talc in the froth and aiding in froth control.

The quantity of acid used is less significant than the pH of the flotation feed. The flotation process should be controlled by using that quantity of acid necessary to obtain the pH which gives good results. According to the experiments shown in Table 12, a pH range of 6.9 to 7.8 will give a Float-1 product containing 97 to 98 per cent platy talc.

In milling practice, the mill water and the ore may vary in chemical properties so that if a fixed amount of acid is used there will be no control over the flotation feed pH.

Comparison of HCl with H₂SO₄ as Flotation Reagents

Comparative experiments were made to determine whether sulfuric acid, which is less expensive, could be used in place of hydrochloric acid. The results are given in Table 13.

TABLE 12. EFFECT OF HCl ON FLOTATION RESULTS

Test No.	Weight Per Cent	Mineral Count, per cent				Pounds Reagent Added Per Ton of Feed			Pulp, pH
		Platy	Nonplaty	Dolomite	Tremolite	HCl	Dowfroth 200		
Test 58 (11.2 per cent feed solids)									
Float-1	51.0	98	<2	<1	<1	1.13	0	7.8	
Float-2	23.8					0	0.13	8.1	
Underflow	25.2					-	-		
Total	100.0								
Test 59 (11.5 per cent feed solids)									
Float-1	50.3	97	<3	<1	<1	2.26	0	6.9	
Float-2	28.5					0	0.13	8.1	
Underflow	21.2					-	-		
Total	100.0								
Test 60 (10.6 per cent feed solids)									
Float-1	46.6	95	2	1	2	6.82	0	6.2	
Float-2	26.7					4.26	0.13	3.7	
Underflow	26.7					-	-		
Total	100.0								
Test 78 (10.6 per cent feed solids)									
Float-1	59.3	98	1	1.1	0	2.30	0.07	7.5	
Float-2	25.1					0	0.25		
Underflow	15.6					-	-		
Total	100.0								
Test 79 (10.0 per cent feed solids)									
Float-1	60.4	96	2	1.2	0	0	0.09	8.7	
Float-2	24.1					0	0.33		
Underflow	15.5					-	-		
Total	100.0								

Note: The feed for each test above was the cyclone underflow from a C-12 or C-14 type treatment.

TABLE 13. COMPARISON OF HCl WITH H₂SO₄ AS A FLOTATION REAGENT

	Weight Per Cent	Mineral Count, per cent				Reagents Added, lb/ton of flotation feed				Pulp, pH	Feed, % solids	
		Platy		Nonplaty		Dolomite	Tremolite	H ₂ SO ₄	HCl			Dowfroth 200
Test 61												
Float-1	57.4	98	1	0.6	<1	0	1.75	0.07	7.2	8.3		
Float-2	20.8	97	2	1.1	<1	0	0	0.20	7.6			
Underflow	21.8	Not evaluated				-	-	-				
Total	100.0											
Test 87												
Float-1	45.2	96	2	1	<1	2.5	0	0.07	7.2	8.0		
Float-2	32.7	Not evaluated				0	0	0.20	7.8			
Underflow	22.1	Not evaluated				-	-	-				
Total	100.0											

Note: Flotation feed was the cyclone underflow.

Tests 61 and 87, made under almost identical conditions, show that H_2SO_4 is not a good substitute for HCl. When using H_2SO_4 the Float-1 product contained 96 per cent platy talc in 45.2 per cent of the weight compared with Test 61 using HCl which yielded 98 per cent platy talc in 57.4 per cent of the weight. In both of these tests Dowfroth 200 was used as the frothing agent.

Effect of Different Types of Water on Quality
And Recovery of Finished Product

Most laboratory flotation tests are made with either distilled or soft water. The reason for this is that certain anions and cations generally present in tap water will activate or depress certain minerals. The number of variables involved during an experimental program can be minimized by using distilled or soft water. Because talc is such a sensitive floater, distilled water, containing virtually no stray ions, was used in all preceding investigations.

From a commercial standpoint, distilled water is expensive and deionized or demineralized water is usually a satisfactory alternative. However, it is more expensive than soft water which in turn is more expensive than tap water.

Because the intended pilot plant and any commercial operation would use a substantial amount of water, it was necessary to determine what problem the different types of water might contribute to the process.

A comparison of the results obtained from the use of tap, deionized, soft, and distilled waters is given in Table 14.

Table 14 shows that soft water gave only 42.7 per cent weight recovery and 93 to 95 per cent platy talc content in the float product. Ordinarily soft water, as a mineral slurry agent, is beneficial in nonmetallic

TABLE 14, COMPARISON OF FLOTATION RESULTS OBTAINED FROM THE USE OF TAP,
DEIONIZED, SOFT, AND DISTILLED WATER

Test No.	Product	Water Used	Weight Per Cent	Mineral Count, per cent			Pulp, pH	Reagents Added, lb/ton of flotation feed		Remarks	
				Platy	Non-platy	Tremolite (a)		HCl	Dowfroth 200		
100 98	Float-1 Float-1	Tap Tap	60.9 60.9	97 97	1 2-3	0.9 0.8	<1 <1	7.3 8.6	1.75 0	0.07 0.06	Dull luster Dull luster
115 116	Float-1 Float-1	Deionized Deionized	56.3 60.6	97 96	<2 2	0.5 0.8	<1 1	6.8 7.1	1.57 0	0.06 0.07	Good luster Good luster
119 120	Float-1 Float-1	Soft Soft	42.7 42.6	93 95	4 3	0.6 1.1	2 1	7.2 7.7	1.63 0	0.06 0.07	Medium luster Medium luster
102 101	Float-1 Float-1	Distilled Distilled	54.7 62.2	97 98	2 1	0.6 0.6	<1 <1	6.8 7.1	1.74 0	0.07 0.07	Good luster Good luster

(a) Per cent dolomite is calculated from chemical analysis of CO₂.

Note: All tests were made with all conditions, except the water, as nearly the same as possible.

flotation processes. Although reasonable guesses can be made for the cause of this effect, not enough tests were made to establish conclusive evidence. The Float-1 products obtained when tap, deionized, or distilled waters were used were mineralogically the same, about 97 to 98 per cent platy talc. The Float-1 products obtained when tap water was used had a dull luster. It was decided on this basis that deionized water, being cheaper than distilled water would be the most practical water to use.

The deionized water used in the tests had a resistance of about 140,000 ohms per cubic centimeter of water. Columbus tap water had a total hardness of 92 ppm and contained 261 ppm of total solids with a pH of 10.1 and a resistance of about 5000 ohms per cubic centimeter. The zeolite softened water used in the experiments had a resistance of 3750 ohms per cubic centimeter.

Effect of Feed Pulp Density on Quality and Recovery of Finished Product

The effect of flotation pulp density on the froth product is important to the process. The higher the pulp density that can be used, the higher the capacity of the equipment, or the higher the rate of production.

Ordinarily high feed pulp densities tend to yield high weight recoveries but this advantage is usually offset by an intermediate quality froth product.

When considering ores in general, an average pulp density for flotation feed is about 25 to 30 per cent solids. The amount or weight of mineral floated is usually less than 25 per cent of the feed weight and the specific surface area is low, as compared with platy minerals such as talc. These conditions do not exist with talc of the Italian No. 2 type and, therefore, some modifications in normal procedure are required.

In the first place, the potential weight of mineral floated may be as high as 90 per cent of the feed weight because the platy talc content is 90 per cent in the feed. Because of the platelet type of mineral structure, as opposed to the blocky type, the specific surface of the material is high which means that there are many more particles per unit of weight than with the blocky type of mineral. Finally, when a mineral as soft as talc is crushed and ground, a significant proportion of the weight is unavoidably ground to a particle size finer than 10 or 15 microns. Particles this fine are always troublesome in flotation circuits because they are large reagent consumers, and when they enter the froth it becomes voluminous, highly stable, and almost invariably results in the entrapment of unwanted particles which ordinarily would not be floated.

Observations made during many of the early flotation experiments indicated that pulp densities in excess of about 10 to 13 per cent solids created excessively voluminous froths, when testing materials of a high platy content such as Italian No. 2 talc.

If a substantial amount of the minus 10-micron particles are removed, as by a C-14 type cyclone method, before flotation, the froth is not unmanageable.

The results of experiments made at different feed densities are given in Table 15. The feed for each experiment was a cyclone underflow containing about 8 per cent of minus 10-micron particles.

Table 15 shows that 97 to 98 per cent platy talc was made from feed pulps ranging between 10.6 and 8.0 per cent solids.

It was observed during the investigation that, as the per cent of solids in the feed was decreased, the froth became less persistent. Table 15 also shows that, as the percentage of solids was dropped from 10.6 to 8.0, the dolomite trapped in the froth dropped from 1.1 down to 0.3 per cent.

TABLE 15. FLOTATION RESULTS OBTAINED AT DIFFERENT PER CENT SOLIDS OF FEED

Test	Product	Weight Per Cent	Feed Solids, Per Cent	Mineral Count, per cent			Reagents Added, lb/ton of flotation feed		
				Platy	Nonplaty	Dolomite	Tremolite	HCl	Dowfroth 200 Dowfroth 250
78	Float-1	59.3	10.6	98	1	1.1(a)	0	2.3	0.07
79	Float-1	60.4	10.0	97	2	1.2(a)	0	0	0.09
115	Float-1	56.3	8.9	97	<2	0.5(a)	<1	1.57	0.06
63-76	Float-1	54.9	8.3	98	1	0.5(a)	<1	1.75	0.07
134	Float-1	59.0	8.0	98	1	0.3(a)	<1	1.77	0.07

(a) Dolomite assays calculated from CO₂ analyses.

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At 10.6 per cent feed solids the weight recovery was 59.3 per cent and dropped to 54.9 per cent when the feed solids was 8.3 per cent.

Test 134 gave a weight recovery of 59.0 per cent but a stronger frother, Dowfroth 250, was used.

Effect of Amount and Type of Frother Added

Two types of water-soluble frothers were investigated. The original choice of frother for the investigations was Dowfroth 200 made by the Dow Chemical Company, Midland, Michigan. Chemically, it is a polypropylene glycol methyl ether having the general formula $\text{CH}_3-(\text{O}-\text{C}_3\text{H}_6)_x-\text{OH}$ with an average molecular weight of 200. It is 100 per cent water soluble.

The amount of frother used regulates, to a large extent, the weight recovery. An excess of frother will promote voluminous froths resulting in a loss of selectivity in addition to creating material-handling problems.

Experiment 58, using hydrochloric acid and no frother, shows that a 98 per cent platy talc could be produced. Experiments were made with the addition of frother up to about 0.10 pound per ton of feed before the froth product began to become mineralogically degraded. Therefore, a test procedure was established that limited the amount of frother added to the Float-1 step at about 0.08 pound per ton of feed. Table 16 shows some comparative results obtained in this range of operation.

A stronger frother, Dowfroth 250, having the same general formula as Dowfroth 200 but with a molecular weight of 250, was also investigated, but not extensively. Results of these tests for comparative purposes are included in Table 16.

TABLE 16. FLOTATION RESULTS OBTAINED USING DIFFERENT AMOUNTS OF FROTHER AND ALSO A STRONGER FROTHER

Test	Product	Weight Per Cent	Reagents Added, lb/ton of flotation feed			Mineral Count, per cent			
			HCl	Dowfroth 200	Dowfroth 250	Platy	Nonplaty	Dolomite	Tremolite
58	Float-1	51.0	1.13	0	0	98	<2	<1	<1
63-76	Float-1	54.9	1.75	0.07	0	98	1	0.5(a)	<1
110	Float-1	61.6	0	0.08	0	97	2	<1	<1
138	Float-1	52.2	2.02	0	0.03	97	2	0.4(a)	1
133	Float-1	53.3	1.59	0	0.06	98	1	0.4(a)	<1
134	Float-1	59.0	1.77	0	0.07	98	1	0.3(a)	<1

(a) Per cent dolomite is calculated from chemical analysis of CO₂.

Table 16 shows that as the amount of frother is increased, the per cent of weight recovered increases. When no frother was used the weight recovery was 51.0 per cent and increased to 61.6 per cent when 0.08 pound of Dowfroth 200 was used per ton of feed.

When 0.03 pound of Dowfroth 250 was used per ton the weight recovered was 52.2 per cent. This was increased to 59.0 per cent by using 0.07 pound per ton of feed.

A good comparison of the relative strength of the two frothers is noted by comparing Tests 63-76 with Test 134. The results show that Dowfroth 250 floated 4.1 per cent more talc than Dowfroth 200 when 0.07 pound per ton was used.

All of the flotation experiments made on Italian No. 2 talc are not discussed in the text of this report. A complete tabulation of the experiments made, showing the pertinent data, is presented in the Appendix.

Drying of Flotation Froth Products

All froth products from the flotation experiments were filtered and washed, and dried in a gas-fired oven at about 350 F. However, in a commercial drying operation, such as spray drying, the temperature might be up to about 1000 F for instantaneous periods in the inlet zone of the drier.

Samples of flotation froths were obtained and treated at various temperatures to find the maximum temperature that could be used without damaging the desirable surface properties and appearance of talc. The results are shown in Table 17.

TABLE 17. OBSERVATIONS ON THE CHANGE OF PHYSICAL PROPERTIES
OF TALC AT ELEVATED TEMPERATURES

Temperature, F	Remarks
350	No change in physical appearance
650	Ditto
725	"
975	"
1100	"
1200	Surfaces become tinted
1300	Surfaces definitely tinted
1400	Surfaces definitely tinted
1550	Surfaces creamy color, gritty, beginning to show crystallographic change

From the data in Table 17, it was apparent that about 1100 F was the highest, safe, drying temperature. Temperatures in excess of 1100 F began to produce discoloration and perhaps crystallographic changes. At 1550 F, the talc particles began to take on the appearance of tremolite.

These data indicate that it would be safe to operate a spray drier at a maximum operating temperature of 1100 F without damage to the product, but 1000 F would probably be a safer limiting temperature.

Drying by vacuum and infra-red were considered. Vacuum drying has one advantage in that temperatures only slightly above room temperature can be used. This would minimize the chances of particle deterioration because of temperature. The vacuum-drying process is not continuous and requires considerable capital outlay.

Infra-red heating using electric or gas-fired light wave generators is another possible method of drying the talc product. Because no commercial application of this method for drying of talc or similar materials was known, it was decided not to undertake a unit-process development at this point.

Drying of powders in rotary kilns is widely practiced but it too has some shortcomings. Auxiliary dust collecting equipment is required, the powder is easily contaminated, and localized overheating in the kiln can ruin the product.

A large sample of Italian No. 2 talc was treated by sedimentation to obtain a split at 10-micron particle size for spray drying tests at Bowen Engineering, Incorporated, North Branch, New Jersey. The minus 10-micron portion was prepared to simulate the cyclone overflow product and the plus 10-micron portion was prepared to simulate the flotation froth product. After separating at the proper size, the density of the slurry was adjusted to that anticipated from the pilot-plant thickeners and filters.

The experiments were made in a laboratory spray drier and showed that completely dry products could be obtained on a continuous basis.

Test results showed that the rate of drying in the laboratory spray drier on the plus 10-micron talc could be expected to be about 0.6 to 1.0 pound per minute. The minus 10-micron talc was dried at a rate of about 0.8 pound per minute. The spray drier had a maximum inlet temperature of 1000 F and outlet temperature of 590 F. Recovery of minus 10-micron talc was 81 to 94 per cent and recovery of the plus 10-micron talc was 93 to 96 per cent. The optimum conditions of drying could be established only after a lengthy testing program so these initial results were accepted as suitable for determining the approximate size of pilot-plant equipment.

Filtration of Test Products

It was realized that all of the products obtained from the several beneficiation processes had a potential value and that their recovery was important.

The cyclone overflow, although containing about 70 per cent minus 10-micron particles was 79 per cent platy talc, and probably would be a valuable by-product. Furthermore, only unique circumstances would permit wasting this material to a settling pond, as it could be a public nuisance.

Experiments made in the laboratory established that the cyclone overflow would not settle in a thickener in a practical length of time without the aid of a flocculating agent. Experiments made using Dow Separan 2610, a commercial flocculating agent at about 0.05 pound per ton of solids were successful in creating fast settling flocs of the fine talc.

Samples of the cyclone overflow were treated with Separan 2610 and settled to a pulp density of 16 per cent solids. The flocculated slurry was then tested with an Eimco Test Filter Kit to obtain data on filtering rates. These data are given in Table 18.

Table 18 shows that the maximum rate of filtration was 36.9 pounds of dry cake per square foot of filter cloth per hour. Increasing the drying time (air drying by pulling air only through the filter cake) resulted in very small changes in the residual cake moisture content. When 30 seconds drying time was used, the cake had a moisture content of 44.0 per cent. When 90 seconds of drying time was used, the moisture content dropped to 42.3 per cent. The maximum thickness of cake, 9/32 inch, was obtained with 1-1/2 to 2 minutes forming time. However, this did not result in the highest filtration rate.

The highest filtration rate would probably be obtained by using a 45-second forming time and a 30-second drying time. The calculated filter capacity under these conditions would be about 41 pounds of dry filter cake per square foot of filter cloth area per hour.

TABLE 18. FILTRATION RATES OF FLOCCULATED CYCLONE OVERFLOW

Forming Time, seconds	Vacuum in Hg	Drying Time, seconds	Filtrate Volume, ml	Cake Thickness, inches	Weight Cake, grams		Moisture, per cent	Filtration Rate, lb/ft ² of filtering area/hr
					Wet	Dry		
60	21	30	225	7/32	75.2	41.9	44.0	36.9
60	19	60	230	7/32	79.9	43.4	45.6	28.7
30	19	60	175	5/32	59.9	32.4	45.9	28.5
45	21	60	195	6/32	70.9	38.7	45.4	24.0
120	18	90	325	9/32	115.2	61.2	45.3	23.1
90	18	90	265	9/32	99.9	53.7	44.4	23.7
60	18	90	215	8/32	91.8	49.7	43.8	26.3
30	18	90	90	4/32	47.9	25.9	42.3	17.1

Filter Cloth Type: TF-204, 2/2 twill, multifilament, thread count 75 x 70; airflow 1410 cfm.

Filtration experiments were also made on the combined Float-1 and Float-2 flotation products in a similar manner, except that Separan 2610 was not needed nor desired as a flocculating agent.

A single experiment using 15 inches of Hg vacuum, 15 seconds forming time and 90 seconds drying time, a product was obtained containing 30 per cent moisture at an equivalent rate of 44.5 pounds of dry cake per square foot of filter cloth area per hour. The rate of filtration could be increased by decreasing the amount of drying time to 30 seconds. Later investigations showed that it was necessary to wash the filter cake to remove most of the soluble salts, if the luster of the talc was to be preserved after drying.

Experiments were made to determine how much washing of the filter cake was necessary. The Float-1 product, as obtained from Test 115, was placed in a Büchner filter and the filtrate, containing 500 milliliters of liquid, showed a resistance of 10,500 ohms per ml. The filter cake was washed the first time with 13.5 milliliters of fresh deionized water at 125,000 ohms and the filtrate measured 27,800 ohms. The filter cake was washed the second time with 135 ml of fresh deionized water and the filtrate measured 53,000 ohms. The filter cake was washed a third time with 135 ml of fresh deionized water and the filtrate measured 50,000 ohms. Therefore, two washes were necessary to reach a constant filtrate condition of about 50,000 ohms, indicating that most of the soluble salts were removed. The drop in electrical resistance from 125,000 to 50,000 ohms represents the constant of solubility of the remaining dolomite in the filter cake. The weight of the filter cake being washed was 93.4 grams. This means that 270 milliliters of water were required for 93.4 grams of talc, which is equivalent to 0.35 gallon of de-ionized water to wash 1.0 pound of talc during filtration.

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PROPOSED PILOT-PLANT FLOWSHEET

Figure 2 shows the proposed pilot-plant flowsheet for treating Italian No. 2 talc.

This flowsheet was developed from data obtained from experiments with laboratory equipment, and more specifically from results of cyclone and flotation tests up through cyclone Test C-14 and flotation Test 76.

In the flowsheet shown in Figure 2, several waste products are indicated. These are from the thickener overflows, filtrate from the filters, and the slurry from the dust collectors. The filtrate will be a clear water containing no solids. Thickener overflow will contain some submicron size particles and perhaps some small amount of valuable particles. However, it is estimated that these losses will be negligible. The product obtained as a slurry from the dust collectors should be finer than 2 or 3 microns, and in the pilot plant will be discarded as waste. The amount produced will be weighed and examined for physical properties. If it is found to be significant, it can be combined with the by-product material. The plan is to recover only part of the potential by-product for use as a market survey material. According to the flowsheet the by-product is made up of the primary and scavenger cyclone overflows and the scavenger flotation underflow. Each of these products has distinctively different properties but will be combined in the pilot plant because of economy and simplicity of operation. The primary cyclone overflow should contain about 70 per cent of minus 10-micron particles, 2 to 3 per cent dolomite, and represent about 35 per cent of the plant feed. The scavenger flotation tailing may contain 10 to 15 per cent of minus 10-micron particles, 8 to 10 per cent dolomite, and represent 15 to 20 per cent of the plant feed. Provisions will be made in the pilot plant to collect these products separately, as well as combined, so that they can be evaluated as individual by-products.

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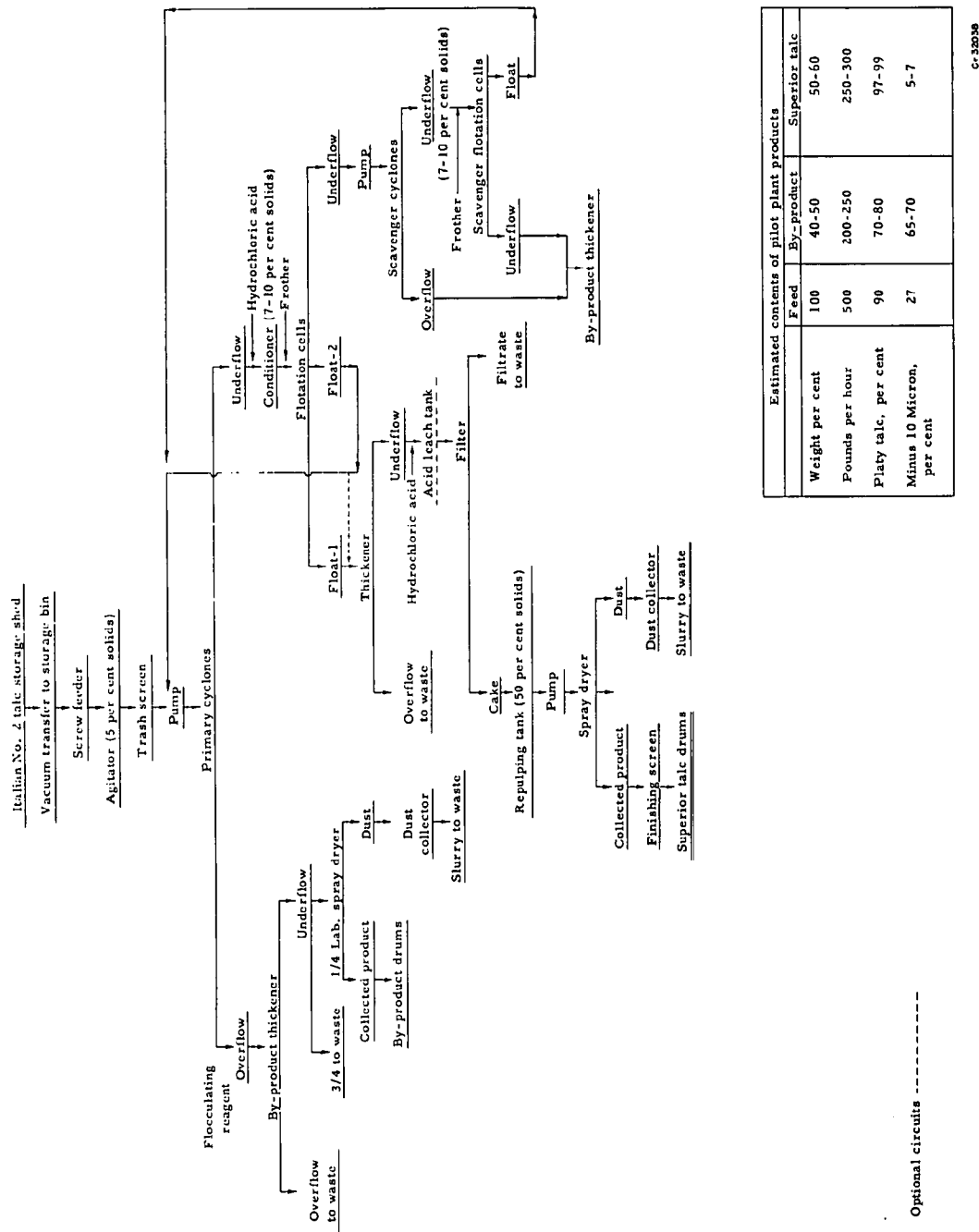


FIGURE 2. PROPOSED PILOT PLANT FLOWSHEET

The Superior Talc is obtained by passing the spray drier product through a finishing screen.

The flowsheet shows a provisional circuit for shunting all or part of the Float-2 product to the Float-1. This will be done if the Float-2 quality is equal to the Float-1, which would be a very desirable condition. Some experiments indicated that this may be possible.

Also shown in Figure 2 is a step for leaching out the residual dolomite in the Float-1 product after removal from the thickener. At the time of this report, complete data are lacking on an ideal method to do this. Preliminary tests were made showing that it was impractical to thicken and leach simultaneously. The reason for this is probably because good mixing and intimate acid-solid contact is not obtained in the gentle action in a thickener.

By cycloning and flotation it was possible to decrease the dolomite content from slightly over 2 per cent in the original ore to 0.2 to 0.3 per cent in the Float-1 froth product. This is a tenfold reduction, but still not enough to yield a nonalkaline powder; some buffering agent would be required to obtain complete neutralization of the finished product unless successful leaching is employed.

CONCLUSIONS

Data and observations obtained from the cyclone and flotation experiments to date have established that:

- (1) Italian No. 2 talc can be beneficiated by flotation alone to give a product which contains about 98 per cent platy talc.
- (2) Flotation alone, which gives a high-purity product, does not remove or reject a sufficient amount of the fine talc and dolomite to make a satisfactory product.

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- (3) Flotation of feed, after removal of the minus 10-micron particles by hydraulic cycloning, yields a superior talc product containing 97-99 per cent platy talc with less than 7 per cent of the weight finer than 10 microns.
- (4) The highest quality products were obtained when the flotation feed pulp pH was between 6.8 and 7.8.
- (5) Feed pulp densities in excess of about 8 per cent solids yield voluminous froths and give poor rejection of dolomite, although this is offset somewhat by improved weight recovery.
- (6) Hydrochloric acid is helpful in the flotation step as a depressant for fine talc and nonplaty minerals.
- (7) Water-soluble frothers such as Dowfroth 200 and Dowfroth 250 are good promoters for the flotation of platy talc. Dowfroth 250 is a stronger promoter than Dowfroth 200. About 0.08 pound of frother per ton of flotation feed solids was the maximum amount added to produce a Float-1 product, otherwise the platy content of the froth product is lowered.
- (8) Sulphuric acid is not a satisfactory substitute for hydrochloric acid for pulp pH control.
- (9) Deionized water is probably the best water to use to form the talc slurry. Tap water gives products with a dull luster, although the platy content is about 97 per cent. Soft water gives products with a medium luster, but the recovery is low and the platy content is not improved over the feed material. Talc processed with deionized water gives the good luster and good recovery.

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- (10) Drying beneficiated products at temperatures up to 1100 F does not alter the surface properties of the talc. Above 1100 F the talc begins to discolor and become gritty.
- (11) In order to retain a good luster on the flotation product, it is necessary to wash out, during filtration, the soluble salts contained in the slurry. The amount needed in the laboratory experiments was about 0.35 gallon of water per pound of talc.

Table 19 shows a comparison of the Sponsor's specifications with Italian No. 1 talc, which is their current raw talc source, and also with the beneficiated talc produced from Italian No. 2 as a raw material.

This table shows an improvement in all categories except that of fitting into the specified bulk density range of 22 to 27 pounds per cubic foot. The probable reason for this is that there is a relationship between the bulk density and the particle shape and size distribution of the powder. Within certain limits, removal of the fines will result in an increase in bulk density. Hence, any beneficiated product with all the 10-micron particles removed should have a higher bulk density than the whole mixture.

FUTURE WORK

Further work is in progress to evaluate additional commercial alcohol frothers, as well as certain flotation modifiers such as the Aerosols.

Undoubtedly, certain problems unknown at this time will become evident during the pilot-plant operation, and some additional laboratory work may be necessary to solve them.

TABLE 19. COMPARISON OF SPECIFICATIONS OF ITALIAN NO. 1 WITH ITALIAN NO. 2 BENEFICIATED TALC

Physical Property Control	Specification	Italian No. 1	Beneficiated Italian No. 2(a)
Moisture:	<0.15 per cent	0.05	<0.05 per cent
Solubility in HCl:	<6 per cent	2.10-2.81	<0.75 per cent
Fineness:	Not less than 98.5 per cent through 200 mesh	99.8 per cent	99.5 per cent
Bulk Density:	Not less than 22 nor more than 27 lb/ft ³	23.0	<0.5 ÷ 200 mesh 28.8
Microscopic Structure:	Platelet showing no acicular nor excessive granular crystals	88-90% Platy 8% Nonplaty <2% Carb Trace tremolite	97-99% Platy 1-2% Nonplaty <1% Carb Trace tremolite
Desirable			
Dust, minus 10 micron	Low	25-30	5-7%
Luster	High	Fair	Good (better than Italian No. 1)
Dolomite	<0.05 per cent	<2 per cent	<0.5 per cent
pH	7.0-7.5	9.0-9.3	8.1-8.3
Lubricity Index	>1.05	1.01	1.10

(a) Beneficiated talc obtained from procedure similar to Flotation Tests 63-76.

The original notes on the laboratory work described in this report are in Battelle Laboratory Record Books 14265, 14668, 15042, 15190, 15456, and 15662. The work was done in the period from May 12, 1958, to May 15, 1959. Some of the discussions on flotation refer back to data presented in the First Progress Report of May 23, 1958, on the Physical Concentration of Talc Ores--Flotation.

WEB:lb

APPENDIX

SUMMARIZED RESULTS OF ALL FLOTATION TESTS
MADE ON ITALIAN NO. 2 TALC

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APPENDIX

SUMMARIZED RESULTS OF ALL FLOTATION TESTS MADE ON ITALIAN NO. 2 TALC

Test	Product	Weight Per Cent	Mineral Count, per cent		Per Cent Dolomite(a)	Feed Solids, per cent	Pulping Water	pH of Float	Reagents Used, lb/ton of flotation feed			Feed-Preparation Cyclone Pressure, psi	Remarks
			Platy	Nonplaty					Dowroth HCl	250	Other		
			Dolomite	Tremolite									
57	Float-1	51.0	98	<2	<1	<1	11.2	Distilled	7.8	1.13		14.7	Discarded because of contamination Submitted to and approved by J & J, 5-7-59
58	Float-2	23.8						Distilled	8.1	0.13			
59	Float-1	50.3	97	23	<1	<1	11.5	Distilled	6.9	2.26		14.7	
	Float-2	28.5						Distilled	8.1	0.13			
60	Float-1	46.6	95	2	<1	2	10.6	Distilled	6.2	6.82		14.7	
61	Float-2	26.7						Distilled	3.7	4.26	0.13		
62	Float-1	57.4	98	1	<1	<1	8.3	Distilled	7.2	1.75	0.07	14.7	
63	Float-2	20.8	97				1.1	Distilled	7.6	0.20			
64	Float-1	52.2	98	<1	<1	<1	9.1	Distilled	10.0	0.06	0.2(b), 0.25(c)	14.7	
65-76	Float-2	22.7						Distilled	8.4	0.18			
	Float-1	54.9	98	1	<1	<1	8.3	Distilled	7.6	1.75	0.07	14.7	Bulk density 29.3 lb/ft ³
	Float-2	24.6	97	<2	<1	0.9		Distilled	7.8	0.28			
77C17	Underflow	20.5	85	4	8-10	2	8.3	Distilled					
78	Scavenger Float(d)	53.0	96	3	<1	<1	8.1	Distilled	8.4	0.17		14.7	
79	Float-1	59.3	98	1	Trace	1.1	10.6	Distilled	7.5	2.3	0.07	14.7	
80	Float-2	25.1						Distilled	8.7	0.25		14.7	
81	Float-1	60.4	97	2	Trace	1	10.0	Distilled	8.1	1.05	0.15	Not cycloned	Feed washed with distilled water for removal of soluble salts; froth not satisfactory
82	Float-2	24.1						Distilled	1.6	0.20		Not cycloned	
83	Float-1	51.8	96	3	<1	<1	8.2	Distilled	1.6	0.65(e)		Not cycloned	Froth poor, unmanageable
84	Float-2	15.4						Distilled	1.6	0.20		Not cycloned	
85	Float-1	71.2	Not evaluated(e)				8.2	Distilled	1.6	0.20		Not cycloned	Free-running froth but difficult to break down
86	Float-2	8.6						Distilled	1.6	0.20		Not cycloned	
87	Float-1	Discarded					8.2	Distilled	1.6	6.5(e)		Not cycloned	Free running, stable froth, not satisfactory
88	Float-2	Discarded					8.2	Distilled	3.9	5.2(e)		Not cycloned	
89	Float-1	Discarded					8.2	Distilled	2.25	0.35		Not cycloned	Feed to flotation - prewashed and filtered
90	Float-2	60.0	Not evaluated					Distilled					
91	Float-1	19.9					8.0	Distilled	6.8	0.07	2.5(f)	14.7	Used H ₂ SO ₄ in place of HCl (see also tests 143-146 inclusive)
92	Float-2	45.2	96	2	1	<1		Distilled		0.20			
93	Float-1	32.7						Distilled					Water not soft, test invalid
94	Float-2	57.3	Demonstration test, not evaluated					Distilled					
95	Float-1	30.3					8.4	Soft	7.5	1.75	0.07	14.7	Water not soft, test invalid
96	Float-2	64.8	98	1	<1	<1	0.5	Soft	7.8	0.26			
97	Underflow	14.1	93	4	1-2	<1	2.5	Soft					Dull luster
98	Float-1	63.7	96	4	<1	<1	0.5	Soft	8.0	0.06		14.7	
99	Float-2	22.4	91	6	1-2	<1	2.9	Soft	8.0	0.25			Dull luster
100	Float-1	60.6	97	3	<1	<1	0.8	Tap	8.6	0.07		14.7	
101	Float-2	22.4	92	5	2	<1	2.2	Tap	7.6	0.25			Dull luster
102	Float-1	48.2	96	2	<1	<1	0.4	Tap	7.1	1.75		14.7	
103	Float-2	33.6					1.5	Tap	7.4	0.26			Dull luster
104	Float-1	60.9	97	1	<1	<1	0.9	Tap	7.3	1.75	0.07	14.7	
105	Float-2	19.5	93	4	2	<1	2.3	Tap	7.5	0.28			Dull luster
106	Float-1	62.2	98	1	<1	<1	0.6	Distilled	ND	0.07		14.7	
107	Float-2	26.6	96	1	<1	<1	3.1	Distilled		0.26			Quality of water in doubt, dull luster
108	Float-1	54.7	97	2	Trace	<1	0.6	Distilled	6.8	1.74	0.07	14.7	
109	Float-2	30.6	96	2	<1	<1	1.4	Distilled		0.25			Quality of water in doubt, dull luster
110	Underflow	14.7					8.9	Distilled					
111	Float-1	57.7	98	2	<1	<1	8.0	Soft	8.4	1.45	0.06	14.7	Quality of water in doubt, dull luster
112	Float-2	24.6	93	6	<1	<1	7.0	Soft	7.1	3.36	0.06	14.7	
113	Float-1	25.2	92	7	<1	<1		Soft	7.8	0.24			6.5 per cent minus 10 microns
114	Float-2	63.5	97	2	<1	<1	7.0	Deionized	7.1	2.00	0.08	14.7	
115	Float-1	23.5						Deionized	7.0	0.30			6.4 per cent minus 10 microns
116	Float-2	61.6	97	2	<1	<1	6.5	Deionized	8.6	0.08		14.7	
117	Float-1	24.2						Deionized	7.3	0.32			

157301

SUMMARIZED RESULTS OF ALL FLOTATION TESTS MADE ON ITALIAN NO. 2 TALC
(Continued)

Test	Product	Weight Per Cent	Mineral Count, per cent			Per Cent Dolomite ^(a)	Feed Solids, per cent	Pulping Water pH of Float	Reagents Used, lb/ton of flotation feed				Feed-Preparation Cyclone Pressure, psi	Remarks
			Platy	Nonplaty	Tremolite				HCl	200	250	Other		
111	Float-1	47.7	Not evaluated, see remarks				7.5	Soft	7.1	1.90	0.07		14.7	Softness of water in doubt, test rerun later (see Tests 117-120 inclusive)
	Float-2	36.8						Soft	7.4	0.28				
112	Float-1	45.9	Not evaluated, see remarks				8.4	Soft	8.4	0.05			14.7	Softness of water in doubt, test rerun later (see Tests 117-120 inclusive)
	Float-2	39.4						Soft	7.6	0.25				
113	Float-1	52.2	Not evaluated, see remarks				8.2	Soft	6.8	0.06			14.7	Softness of water in doubt, test rerun later (see Tests 117-120 inclusive)
	Float-2	35.2						Soft	7.1	0.26				
114	Float-1	59.4	Not evaluated, see remarks				7.6	Soft	8.3	0.07			14.7	Softness of water in doubt, test rerun later (see Tests 117-120 inclusive)
	Float-2	30.5						Soft	7.2	0.28				
115	Float-1	56.3	97 <2 <1		<1	0.6	8.9	Deionized	6.8	0.06			14.7	
	Float-2	30.3	94 2 >2		<2	2.0		Deionized	7.0	0.23				
116	Float-1	60.5	96 2 <1		2	0.8	8.0	Deionized	7.1	0.07			14.7	
	Float-2	27.6				2.6		Deionized						
117	Float-1	39.3	94 3 2		1		8.6	Soft	6.7	1.63	0.06		14.7	
	Float-2	45.5	93 2 2		2			Soft	8.2	0.25				
118	Float-1	38.4	93 6 <1		1		7.7	Soft	7.3	0.27			14.7	
	Float-2	47.0					8.6	Soft	7.2	1.53	0.06		14.7	
119	Float-1	42.7	93 4 <1		2	0.5		Soft	7.6	0.24				
	Float-2	40.4				2.2		Soft	7.4	0.15				
120	Float-1	9.2	95 3 1		1	1.1	7.9	Soft	7.7	0.07			14.7	
	Float-2	42.6						Soft	7.6	0.27				
127	Float-1	43.5	98 2 <1		<1	0.3	8.7	Deionized	6.9	1.62	0.03		23.0	
	Float-2	40.8						Deionized	6.7		0.28			
128	Float-1	54.3	97 2 <1		<1	0.4	9.5	Deionized	6.9	1.46	0.06		23.0	
	Float-2	31.5					6.6	Deionized	6.6		0.29			
133	Float-1	53.3	98 1 <1		<1	0.4	8.9	Deionized	6.6	1.59	0.06		23.0	
	Float-2	32.0						Deionized	6.9		0.25			
134	Float-1	59.0	98 1 <1		<1	0.3	8.0	Deionized	6.7	1.77	0.07		23.0	
	Float-2	25.6						Deionized	6.8		0.28			
135	Float-1	58.0	97 1 <1		<1		8.2	Deionized	6.8	1.72	0.07		14.7	
	Float-2	27.1						Deionized	7.0		0.27			
136	Float-1	55.0	96 2 <1		<1		8.0	Deionized	6.4	1.77	0.07		14.7	
	Float-2	30.3						Deionized	7.0		0.28			
137	Float-1	54.0	96 3 <1		<1	0.3	8.4	Deionized	6.4	2.02	0.07		14.7	
	Float-2	30.8						Deionized	7.2		0.27			
138	Float-1	52.2	97 2 <1		<1	0.4	8.4	Deionized	6.5	2.02	0.05		14.7	
	Float-2	33.4						Deionized	6.8		0.28			
139	Float-1	46.2	96 2 1		1	0.3	8.5	Deionized	6.4	2.00	0.03		14.7	
	Float-2	38.1						Deionized	6.7		0.30			
140	Float-1	53.2	96 2 <1		<1	0.3	8.2	Deionized	6.2	2.40	0.07		14.7	
	Float-2	29.6						Deionized	5.5	0.33	0.27			
143	Float-1	49.3	96 <3 <1		<1	0.2	8.2	Deionized	6.2	0.06	0.27	2.4(f)	14.7	Used H ₂ SO ₄ in place of HCl
	Float-2	31.1						Deionized	6.7	0.26				
144	Float-1	58.2	95 2 <1		<1	0.2	8.4	Deionized	6.1		0.07	2.35(f)	14.7	Used H ₂ SO ₄ in place of HCl
	Float-2	28.2						Deionized	6.5		0.27			
145	Float-1	52.9	95 3 <1		<1	0.3	9.0	Deionized	6.2	0.06	0.27	2.17(f)	23.0	Used H ₂ SO ₄ in place of HCl
	Float-2	28.8						Deionized	6.5	0.29				
146	Float-1	56.5	95 3 <1		<1	0.2	8.9	Deionized	6.4		0.07	2.21(f)	23.0	Used H ₂ SO ₄ in place of HCl
	Float-2	28.4						Deionized	6.7		0.27			
149	Float-1	47.0	97 3 <1		<1	0.2	8.1	Deionized	6.9	1.57	0.04		23.0	7.0 per cent minus 10 microns
	Float-2	38.0						Deionized	7.1		0.31			9.0 per cent minus 10 microns
150(a)	Float-1	41.0	93 5 <1		<1	0.2	7.0	Deionized	7.3		0.04		23.0	8.4 per cent minus 10 microns
	Float-2	43.0						Deionized	7.6		0.37			9.0 per cent minus 10 microns
151(a)	Float-1	51.3	95 4 <1		<1	0.3	7.0	Deionized	6.3	1.79	0.04		23.0	8.0 per cent minus 10 microns
	Float-2	33.3						Deionized	6.7		0.36			10.5 per cent minus 10 microns
154(a)	Float-1	49.5	95 3 <1		<1	0.5	7.0	Deionized	7.0		0.04		23.0	8.3 per cent minus 10 microns
	Float-2	35.6						Deionized	6.7		0.35			9.4 per cent minus 10 microns
155	Float-1	47.8	98 1 <1		<1	0.3	7.1	Deionized	6.4	1.80	0.07		23.0	
	Float-2	31.8						Deionized	6.4		0.30			
156	Float-1	56.1	97 2		<1	0.4	7.0	Deionized	6.4	1.83	0.08		23.0	
	Float-2	29.8						Deionized	6.7		0.32			

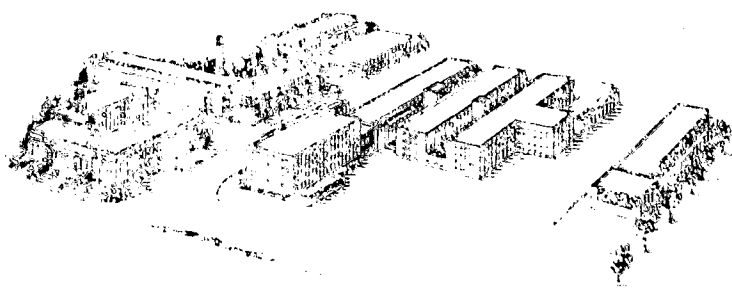
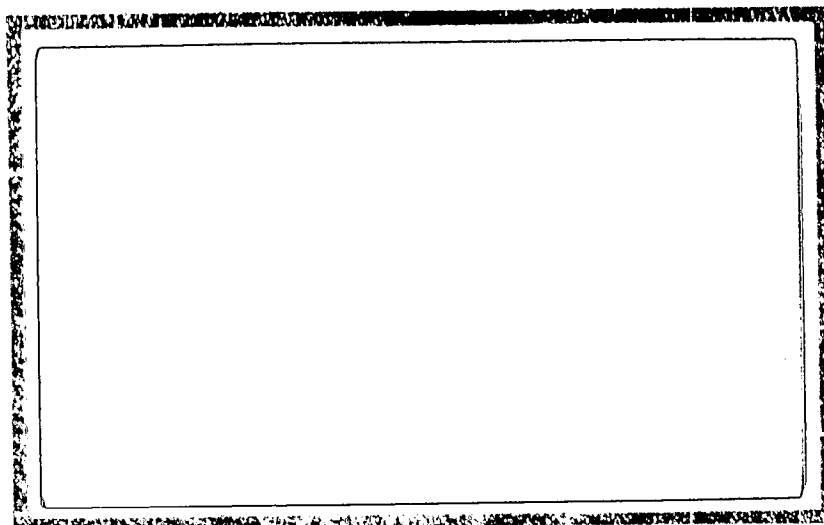
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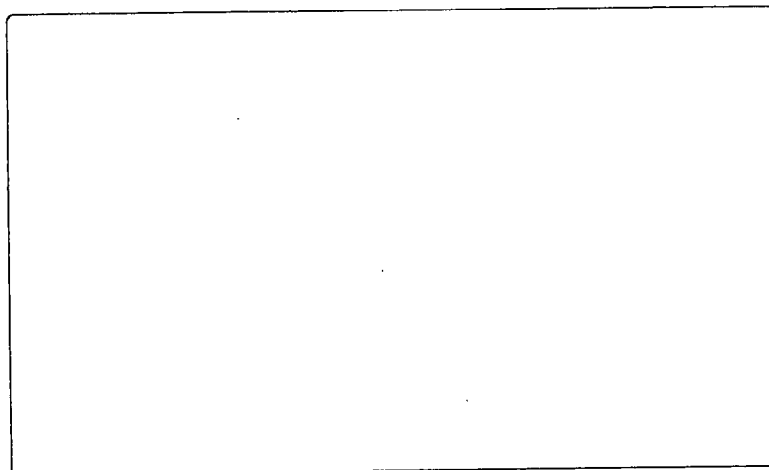
- (a) Per cent dolomite is calculated from chemical analysis of CO_2 .
- (b) Na_2CO_3 .
- (c) $\text{Na}_2\text{P}_4\text{O}_7$.
- (d) Flotation underflows from Tests 63-72 were composited and cycloned.
The cyclone underflow was used as the scavenger feed.
- (e) Aerosol OT was added to improve froth and depress fines. Neither objective obtained. Products not mineralogically evaluated.
- (f) H_2SO_4 was used in place of HCl.
- (g) The platy-talc content of the float products from these tests is lower than expected and not consistent with results obtained in similar tests. There is no satisfactory explanation. The tests were intended to establish the effect of HCl for depressing minus 10-micron particles.

Exhibit 40

SUMMARY REPORT



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BIOCHEMISTRY	MINERALS PROCESSING
BIOPHYSICS	NONDESTRUCTIVE INSPECTION
CERAMICS	NUCLEONICS
CHEMICAL ENGINEERING	OPERATIONS RESEARCH
CORROSION TECHNOLOGY	ORGANIC CHEMISTRY
ECONOMICS	ORGANIC COATINGS
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ELECTROCHEMICAL ENGINEERING	PHYSICAL CHEMISTRY
ELECTROCHEMISTRY	PROCESS METALLURGY
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FOUNDRY PRACTICE	RUBBER AND PLASTICS
FUELS AND COMBUSTION	SOLID STATE DEVICES
GRAPHIC ARTS TECHNOLOGY	SYSTEMS ENGINEERING
HIGH-TEMPERATURE METALLURGY	TEXTILES AND FIBERS
INDUSTRIAL PHYSICS	THEORETICAL AND APPLIED MECHANICS
INFORMATION PROCESSING	THERMODYNAMICS
INORGANIC CHEMISTRY	WELDING TECHNOLOGY

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SUMMARY REPORT

on

ULTRASONIC COMMINUTION OF TALC

to

JOHNSON AND JOHNSON RESEARCH

August 31, 1959

by

J. N. Antonevich, W. E. Chase, and L. E. Walkup

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio

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5 0 5 K I N G A V E N U E C O L U M B U S I , O H I O

October 8, 1959

Mr. W. H. Ashton
Research Department
Johnson and Johnson
New Brunswick, New Jersey

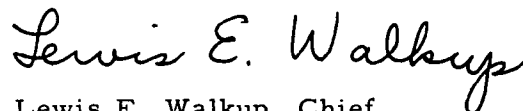
Dear Mr. Ashton:

Work on the project "Ultrasonic Comminution of Talc" has been terminated, as requested during your July 27, 1959, phone conversation with Mr. Macdonald of our Minerals Beneficiation Division.

We are submitting a report on the work done. On the basis of incomplete data, it appears that the ultrasonic comminution of talc can be developed into a useful process for producing high-quality powder. The data are not sufficient as yet, however, to define all the parameters that influence the ultrasonic grinding process. We would be glad to undertake this further work if Johnson and Johnson should decide on the basis of this report to reopen the study. The adaptability of various transducers to determine minimum equipment and operating costs for processing talc with vibratory energy also should be included in any further work.

We enjoyed working on this project. If there are any questions concerning the report, we would be glad to answer them.

Very truly yours,



Lewis E. Walkup, Chief
Applied Physics Division

LEW:mar
Enc. (6)

cc: Dr. W. H. Lycan
Mr. C. V. Swank

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ULTRASONIC COMMINATION OF TALC

by

J. N. Antonevich, W. E. Chase, and L. E. Walkup

SUMMARY

A study was made of the process parameters affecting ultrasonic comminution of plus 200 minus 10-mesh talc to plus 10-micron minus 200-mesh talc. It was found that the rate of comminution in a batch process and a process in which the oversize fraction was recirculated increases linearly with ultrasonic power. At a given power level, the process using a recirculating load was three times more efficient than the batch process. A talc slurry having approximately 40 per cent solids appeared to give optimum comminution rates.

On the basis of line power consumed by the magnetostrictive transducer assembly used in this study, having an over-all efficiency of approximately 15 per cent, the total energy required to grind 1 pound of minus 10-mesh talc to minus 200-mesh talc ranged from 3 to 4 kwhr. The use of fluid dynamic transducers can possibly reduce total energy requirements by a factor of 10.

Ultrasonic grinding appears to be selective in producing platy talc preferentially; the ground plates appear to be thinner than those produced by conventional grinding methods, and about 80 per cent of the individual plates have rounded corners.

There is an indication that some of the impurities in platy talc, although not the carbonate, are finely ground during ultrasonic grinding and can be rejected by simple classification. In one instance a product prepared in this way contained 98 per cent platy talc.

The application of ultrasonic or sonic energy to grinding talc into a high-quality powder appears to be technically feasible. Additional studies will be needed to define the practical limitations of the process.

INTRODUCTION

Prior to this project, exploratory experiments had been conducted using ultrasonic techniques to comminute talc. They indicated that plus 200 minus 10-mesh talc can be comminuted to minus 200 mesh at a power rate of 1800 kwhr/ton. Microscopical examinations of the ultrasonically ground talc showed a high-quality talc, in that individual talc platelets were intact having rounded corners and appearing to be in the thinnest possible platelet form. There appeared to be some degree of selective comminution, i. e., only talc appeared to be comminuted - other minerals in the raw ore were not appreciably broken down.

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The apparent high quality of the ultrasonically comminuted talc and the reasonable power cost estimate of 1 cent per pound (on the basis of 1 cent per kwhr for power) warranted further investigation. On April 1, 1959, an investigation was undertaken on the effects of frequency, power level, and initial particle size on the comminution rate and final particle size of talc exposed to vibratory energy.

This report describes the work done toward establishing the important process parameters affecting the comminution of plus 200 minus 10-mesh talc to plus 10-micron minus 200-mesh high-quality talc.

EXPERIMENTAL PROCEDURE

Investigations were made into the process parameters affecting ultrasonic comminution of plus 200 minus 10-mesh talc to plus 10-micron minus 200-mesh high-quality talc. These process parameters include the solids content of the talc slurry, and the ultrasonic power level as they influence the ultrasonic comminution of talc in a batch process and in a process in which the oversize fraction is recirculated.

A Sheffield-Cavitron Model 1000 A power oscillator and 20-kc transducer (Sheffield Corp., Dayton, Ohio) were used to generate ultrasonic power. Figure 1 shows the experimental arrangement used for most of the experiments. It consists of a stainless steel chamber 4 inches deep, having an inside diameter of 1-3/4 inches. This chamber was inserted within a coil of 1/4-inch copper tubing, and was restrained and gasketed within a steel enclosure constructed about the coil. The temperature of the talc slurry was maintained constant by running tap water through the copper tubing. This eliminated the possibility of temperature influencing the comminution rate. The chamber assembly was fitted over a standard double-cylinder mechanical transformer or horn (Sheffield No. 35-258) having a 1-1/2-inch-diameter radiating face. An O-ring was used as a seal between the cylindrical chamber and the horn.

Relative power supplied to the transducer was monitored by an ammeter in the plate circuit of the power oscillator driving the transducer. It was assumed that the power output of the oscillator was directly proportional to the plate current, and that the oscillator was 50 per cent efficient. With these assumptions, maximum power delivered to the transducer would be 1 kw, the rating of the transducer-oscillator combination. The total maximum power consumed from the line would be 2 kw.

Slurries of desired solids content, composed of plus 200 minus 10-mesh talc and deionized water, were placed in the chamber to form a column 3 inches deep. This depth was chosen as it appeared to produce a resonant column with 20-kc vibrations at any concentration of talc investigated. A resonant column is desired for maximum energy transfer from the transducer to the slurry.

The natural agitation accompanying the ultrasonic treatment of low talc concentration was sufficient to obtain reproducible comminution results. At high solids content, results were not consistent. To obtain consistent results, a stirring motor had to be used to keep talc from settling on the vibrating face of the double-cylinder mechanical transformer.

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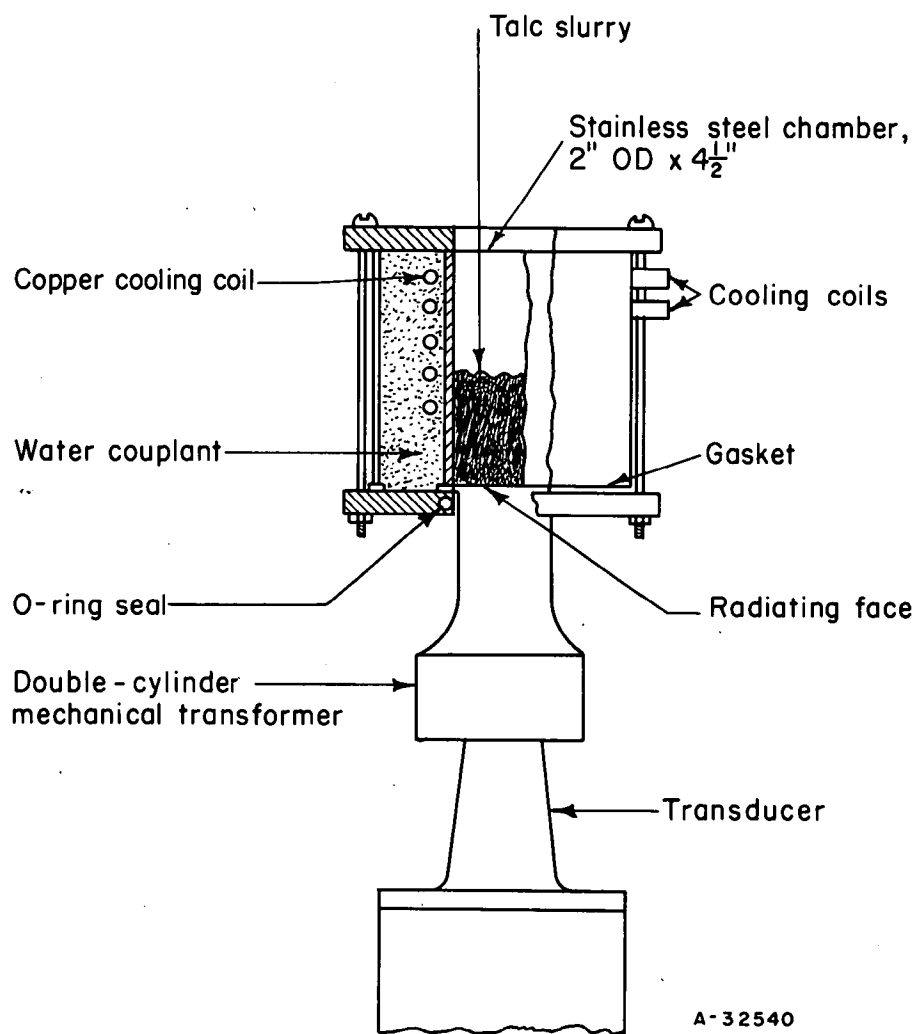


FIGURE 1. ASSEMBLY FOR COMMINUTING TALC WITH 20-KC VIBRATIONS

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The criterion used for comminution was the weight of talc ground sufficiently to pass through a 200-mesh sieve. In the case of batch treatments, the talc was exposed to 20-kc vibrations for 5, 15, and 35 minutes. At the end of each exposure, the talc was sieved, dried, and weighed to determine the amount of talc reduced to minus 200 mesh. In the case of recirculating-load treatments, a given concentration of plus 200 minus 10-mesh talc was given a series of 5-minute treatments. At the end of each 5-minute period, the fines passing through a 200-mesh screen were collected, dried, and weighed. An amount equal to the fines removed was added to the remaining talc to maintain a constant concentration of talc for each time period of treatments.

EXPERIMENTAL RESULTS

A series of experiments was made to determine the comminution characteristics of talc treated in batches. Figure 2 shows the relationship between the amount of a 25-gram talc load comminuted to minus 200 mesh and the time of treatment at various power levels.

A series of experiments also was made to determine the influence of solids content on the ultrasonic comminution of talc. Figure 3 shows the relationship between comminution rate and the solids content for a fixed time of exposure and power level. For the experimental arrangement used, a talc slurry having a 40 per cent solids content appeared to be best. At other power levels and stirring conditions, it is possible that other concentrations would be found better. An ideal arrangement would be one in which the energy density and particle distribution throughout the slurry is uniform. Under such conditions, the rate of comminution might be directly proportional to the solids content as indicated by work reported on the ultrasonic dispersion of Progesterone*.

Figure 4 shows the relationship between maximum batch-comminution rate and electrical power used in processing the talc. The relationships shown are linear for talc loads having 20 and 35 per cent solids content.

A series of experiments also was made to establish the comminution characteristics of talc when a recirculating load was exposed to ultrasonic vibrations. Conditions of a recirculating load were approximated by treating the load for 5-minute periods, removing fines and adding an equal amount of coarse talc at the end of each time period, until the amount of fines removed was constant.

Figure 5 shows the relationship obtained between comminution rate and electrical power for a simulated recirculating load. Figure 6 shows the approximate time required to reach equilibrium in the simulated circulating load at various power levels.

Twelve pounds of minus 10-mesh talc was batch treated using an equivalent of 1.28 kw per 50-gram load in the experimental arrangement. Each batch, or charge,

*Misek, B., and Skaven, D. M., "A Study of Dispersion with Ultrasound", J. Am. Pharm. Assoc., Scientific Edition, XLVII, (1) (Jan. 1958), reprinted in Ultrasonic News, 2 (7), 13-16 (1958).

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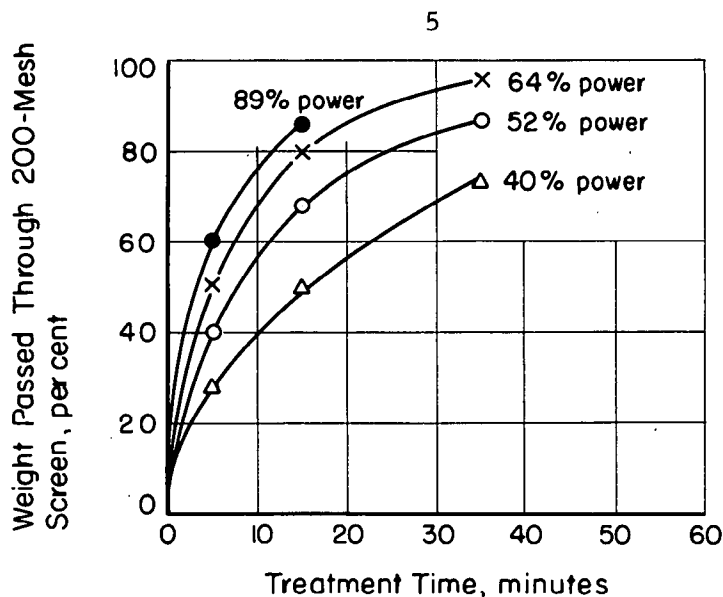


FIGURE 2. RELATIONSHIP BETWEEN AMOUNT OF MINUS 10-MESH TALC COMMINUTED TO MINUS 200 MESH, AND TREATMENT TIME AT VARIOUS ULTRASONIC POWER LEVELS

Frequency of vibration, 20 kc; weight of talc, 25 grams; solids content of slurry, 19 per cent; transducer rating, 1 kw

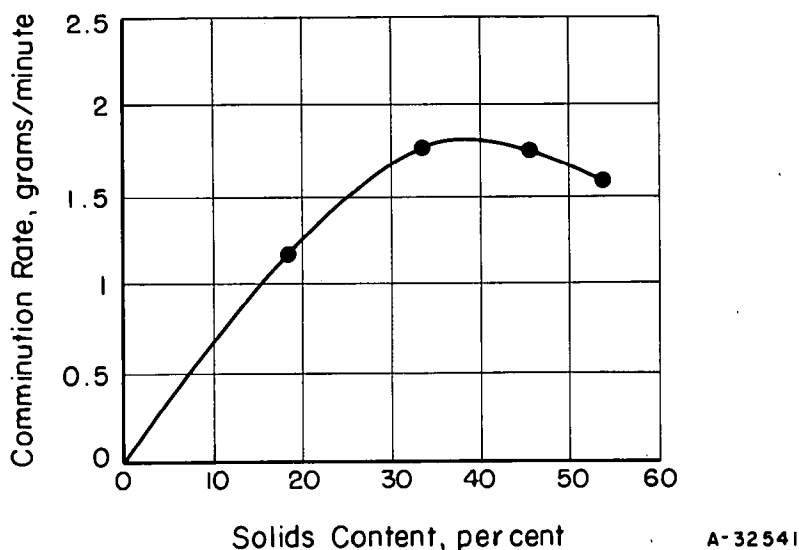


FIGURE 3. RELATIONSHIP BETWEEN COMMINATION RATE AND SOLIDS CONTENT OF A MINUS 10-MESH TALC SLURRY EXPOSED TO 20 KC VIBRATIONS

Exposure time, 15 minutes; transducer driven at 50 per cent rated power; volume of slurry, 118 cm³; talc ground to minus 200 mesh

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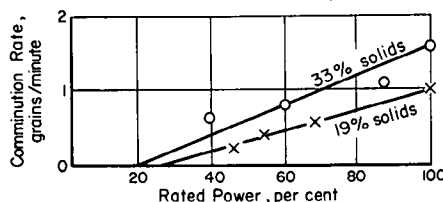


FIGURE 4. RELATIONSHIP BETWEEN COMMINATION RATE AND ULTRASONIC POWER FOR BATCH GRINDING OF 10-MESH TALC TO MINUS 200-MESH TALC

Transducer rating is 1 kw.

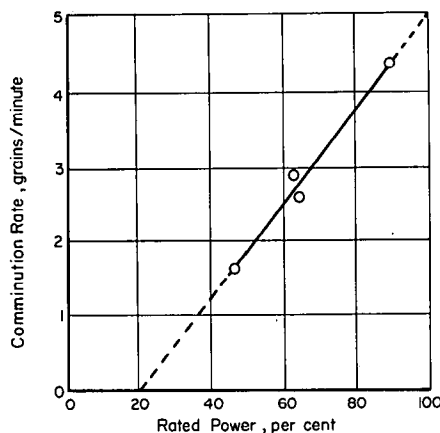


FIGURE 5. RELATIONSHIP BETWEEN COMMINATION RATE AND ULTRASONIC POWER FOR GRINDING A SIMULATED RECIRCULATING LOAD OF 10-MESH TALC TO MINUS 200-MESH TALC

Transducer rating is 1 kw. The solids content of the talc slurry is 33 per cent. Exposure of load was made in 5-minute increments.

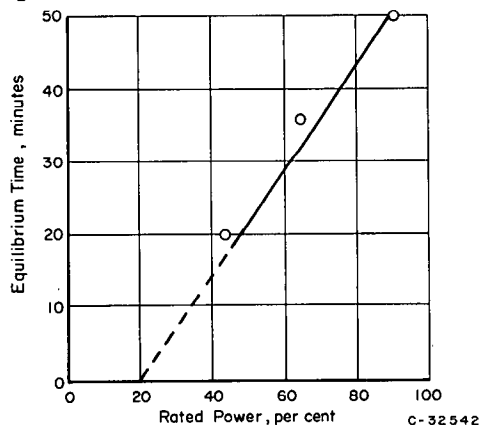


FIGURE 6. RELATIONSHIP BETWEEN EXPOSURE TIME TO REACH EQUILIBRIUM AND ULTRASONIC POWER WHEN GRINDING A SIMULATED RECIRCULATING LOAD OF 10-MESH TALC TO MINUS 200-MESH TALC

Transducer rating is 1 kw and the solids content of the circulating slurry is 33 per cent

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was treated for 5 minutes to obtain an ultrasonically processed talc that could be used for preliminary beneficiation experiments.

A screen and sedimentation analysis of the 12 pounds of ultrasonically ground talc was made. Results were obtained as shown in Table 1.

TABLE 1. SIZE DISTRIBUTION OF COMMINUTED TALC WHEN TREATED WITH 1.28 KW PER 50-GRAM LOAD

Size Fractions	Weight Per Cent
Plus 200 mesh	42.8
Minus 200 mesh plus 10 micron	45.8
Minus 10 micron	11.4
	100.0

Table 1 shows that by the particular experimental arrangement used on the 12 pounds of talc, about 46 per cent of the talc was produced in the desired size range of minus 200 mesh plus 10 microns. The plus 200-mesh fraction accounts for over 42 per cent of the feed. This portion should be removed by screening to be returned and blended with new feed. By this procedure a closed grinding circuit can be simulated.

Information on how the ultrasonically ground talc responds to flotation was obtained from a few preliminary flotation experiments on the 12-pound batch. The ultrasonically ground product was wet screened to remove the 200-mesh oversize. Based on the figures obtained on the screen and sedimentation work, the size distribution of the flotation feed was calculated after the plus 200-mesh fraction was removed.

Table 2 shows the calculated values.

TABLE 2. DISTRIBUTION OF PARTICLE SIZES IN FLOTATION FEED OBTAINED FROM COMMINUTED TALC WHEN TREATED WITH 1.28 KW PER 50-GRAM LOAD

Size Fraction	Weight Per Cent
Minus 200 mesh plus 10 micron	80.1
Minus 10 micron	19.9

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The minus 200-mesh fraction was then cycloned and the resulting minus 200-mesh plus 10-micron fraction was floated. Five flotation experiments were made. The first flotation experiments showed that acicular particles of talc floated with the platelets. Therefore, modifications in the beneficiation procedure were made in an attempt to eliminate these acicular particles. These modifications consisted of using greater dilution during cycloning and in using smaller quantities of reagents during flotation.

Table 3 shows the best flotation separation obtained with talc ground ultrasonically.

TABLE 3. FLOTATION RESULTS OBTAINED FROM ULTRASONICALLY
COMMUNUTED TALC

Product	Weight Per Cent	Microscopic Count, per cent	
		Platy	Nonplaty (Mostly Acicular)
Cyclone overflow	33.0	(a)	(a)
Float 1	39.2	97-98	2-3
Float 2	11.6	96	4
Flotation underflow	16.2	(a)	(a)
Total	100.0		

It is emphasized that neither the grind nor the flotation conditions were considered as being optimum in these five exploratory experiments.

Two other ultrasonically ground samples were submitted to Battelle's Minerals Beneficiation Division for flotation experiments.

These two samples, Series I and II, were made in a simulated recirculating ultrasonic grinding circuit using 90 and 46 per cent of the rated power of the ultrasonic transducer, respectively.

A representative fraction of each of the two samples was treated by sedimentation to determine the amount of minus 10-micron material present. Table 4 shows the distribution of sizes in these fractions.

Table 4 shows that the Series II samples contained 32.4 per cent of the material finer than 10 microns, compared with 43.9 per cent finer than 10 microns in the Series I samples. The lower energy level produced fewer minus 10-micron particles.

The sedimentation products were examined under the petrographic microscope to determine the mineral character. Table 5 summarizes these observations.

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TABLE 4. PARTICLE-SIZE DISTRIBUTION OF SERIES I
AND SERIES II SAMPLES

Product	Weight Per Cent
Series I; minus 200 mesh plus 10 micron	56.1
Series I; minus 10 micron	43.9
Total	100.0
Series II; minus 200 mesh plus 10 micron	67.6
Series II; minus 10 micron	32.4
Total	100.0

TABLE 5. MINERAL CHARACTER OF SERIES I
AND SERIES II SAMPLES

Product	Sedimentation Products, per cent			
	Platy Talc	Nonplaty Talc	Carbonate	Tremolite
Series I; minus 200 mesh plus 10 micron	98	±1	+1	Trace
Series II; minus 200 mesh plus 10 micron	98	<1	+1	Trace
Series I; minus 10 micron	None	72 fines and shards	<1	±4
Series II; minus 10 micron	None	70 fines and shards 25 nonplaty	<1	±5

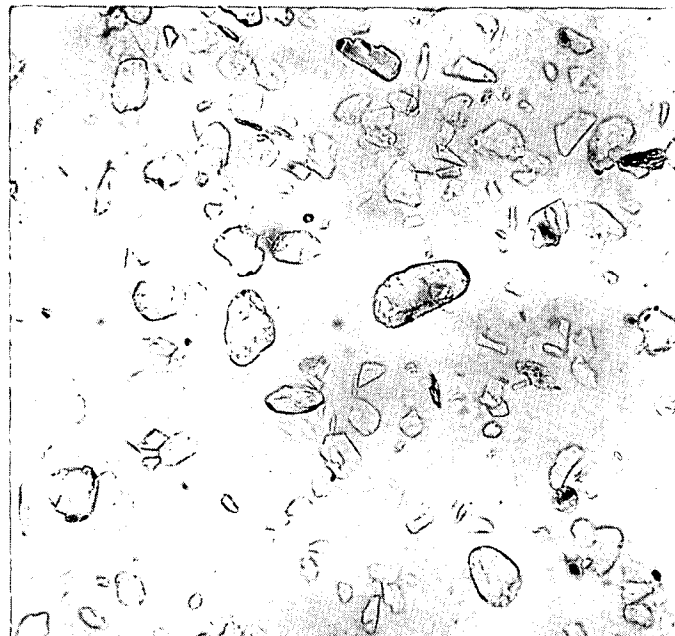
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Microscopic examination showed that both minus 200-mesh plus 10-micron samples (Series I and II) were excellent products. Each contained a large proportion of well-developed platelets, i. e., thin, flat, circular, or rounded. Figure 7 shows a photomicrograph of Series I sedimentation products.



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Plane-Polarized Light

FIGURE 7. PHOTOMICROGRAPH OF MINUS 200-MESH PLUS 10-MICRON FRACTION OF ULTRASONICALLY GROUND TALC

Recirculating load exposed to 46 per cent of rated power of ultrasonic transducer.

Attention is directed to the data of Table 5, which show that talc of very high platy content was obtained simply by sedimentation of the ultrasonically ground talc. The carbonate content of these products, however, is still greater than 1 per cent. A flotation step would be required to eliminate it. These limited experiments should not be taken as conclusive, but there is an indication that at this power level the nonplaty talc is broken down to the minus 10-micron range preferentially by ultrasonic grinding. If further experimental work verifies this trend, it might be possible to produce a high-grade finished talc product from a low-carbonate feed simply by grinding and classification for removal of fines, without the necessity of introducing a beneficiation step such as froth flotation. This same trend has been shown in ball-mill grinding, but to a lesser extent. For instance, the classification for removal of fines from the Italian No. 2 talc, which has been carried out in the talc pilot plant, has increased the platy content from 90 to 95 per cent. This is the same talc on which the ultrasonic grinding

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was done. There is no instance however, where talc of 98 per cent platy quality has been produced without the use of flotation, other than the data of Table 5.

No cyclone or flotation experiments were made on the Series I or II samples, because the development work was curtailed as requested by the Sponsor.

DISCUSSION

Assuming that the conditions used to obtain the above data on the ultrasonic comminution of a circulating load of talc are optimum and that electrical power costs are 1 cent per kwhr, the cost of comminuting 1 pound of 10-mesh talc to minus 200-mesh talc would be from 3 to 4 cents. Therefore, the power cost to process a pound of talc would be almost constant if an electrical generator, such as a rotary generator having low standby losses, could be used. It is estimated that the over-all efficiency of power transformation from electrical to 20-kc vibratory power of the experimental assembly was 15 per cent. In general, the efficiency of electrical power oscillators of the type used is about 50 per cent, and for the type of ultrasonic transducer used 30 per cent. It is conceivable that systems for comminuting talc can be designed with higher over-all efficiencies. This would reduce processing costs. For example, if sonic frequencies are used, in particular 15 kc, then an over-all efficiency in the neighborhood of 30 per cent might be obtained, halving processing costs. A more promising approach would be to use fluid dynamic transducers, which in general have reduced the cost of ultrasonic processes, when applicable, by a factor of 10. A simple experiment had been performed using a blender (230-watt Osterizer, John Oster Mfg. Co., Milwaukee, Wis.) to determine this possibility. Rough estimates indicated that a batch of 10-mesh talc could be ground to 200-mesh talc by this method at a power expenditure of 1 kwhr per pound. It can be assumed that for a circulating load the power expended per pound of processed talc would be much less.

The quality of ultrasonically processed talc appears to be a function of the vibratory energy level to which it is exposed. Observations made of talc-water suspensions after various ultrasonic comminution conditions indicated that batch samples exposed to power levels above 440 watts for any time period produced a colloidal suspension of some of the particles. In general, as the time of exposure or power level increased, the amount of particles colloiddally suspended increased. It was also observed that particles other than talc found in the suspension were not notably fractured at any of the energy levels used. Although work was interrupted before a relationship between initial talc particle size and its ultrasonic comminution rate could be determined, the literature indicates that the smaller the initial particle size the smaller will be the size of the suspended particles after ultrasonic treatment for a given time period. The literature appears to substantiate the possibility of controlled comminution by the ultrasonic process. In the ultrasonic dispersion of Progesterone it was found that the extent of dispersion was directly related to the ultrasonic intensity applied, and that the extent of dispersion was a function of time of application and initial particle size. In a closed-flow circuit ultrasonic comminution process the minimum particle size can be controlled through the rate of flow of talc slurry and the rate of comminution by the ultrasonic intensity or power.

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CONCLUSIONS AND RECOMMENDATIONS

Ultrasonic comminution appears to be a promising method of producing talc powder of a high and controllable quality. The power required to comminute 1 pound of plus 200-mesh talc minus 10-mesh talc to minus 200-mesh talc is estimated at 3.5 kw using magnetostrictive transducers. The applicability of fluid dynamic transducers would be expected to reduce processing costs by a factor of 10 or more.

The minus 200-mesh plus 10-micron talc produced by an ultrasonic comminution is unique in that almost 80 per cent of the platelets are rounded. Other grinding procedures such as roller or pebble milling yield only a few per cent rounded platelets.

Ultrasonic comminution, at the energy levels and the laboratory techniques tried, produced a minimum of 33 per cent of the weight finer than 10 microns when comminution was carried to the point where all the material passed a 200-mesh sieve. Part of the objective of obtaining a small amount of minus 10-micron particles was not obtained. It is believed that standard grinding methods can be controlled to produce less than 20 per cent of the weight finer than 10 microns, but the particles larger than 10 microns do not contain more than a few per cent of rounded platelets.

A 98 per cent platy talc representing 67 per cent of the original weight was obtained by ultrasonic comminution followed by sedimentation for removal of minus 10-micron particles. This product contained 0.69 per cent CO₂ (1.44 per cent dolomite) as the principal contaminant. If elimination of dolomite is important, acid leaching or flotation would be effective.

It is recommended that Johnson and Johnson consider continuing this work to complete studies on the effect of initial particle size of talc and frequency of vibration on the comminution rate of talc. These studies would establish the upper practical limit of particle sizes that can be ground ultrasonically and indicate the practicability of using high-efficiency lower frequency transducers in producing high-quality talc. Work also should be continued to complete the analysis of talc ground under various grinding conditions to definitely establish its quality as compared with talc powder produced by conventional grinding processes.

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PHASE REPORT

on

**AN INVESTIGATION OF THE MEASUREMENT
AND CAUSATIVE FACTORS OF LUSTER
IN FINE PARTICULATE TALCS**

to

JOHNSON AND JOHNSON

September 15, 1959

by

James F. Shea, Charles B. Sclar, and H. B. Kinnear

**BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio**

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S O S K I N G A V E N U E C O L U M B U S I , O H I O

September 24, 1959

Mr. W. H. Ashton
Research Department
Johnson and Johnson
New Brunswick, New Jersey

Dear Mr. Ashton:

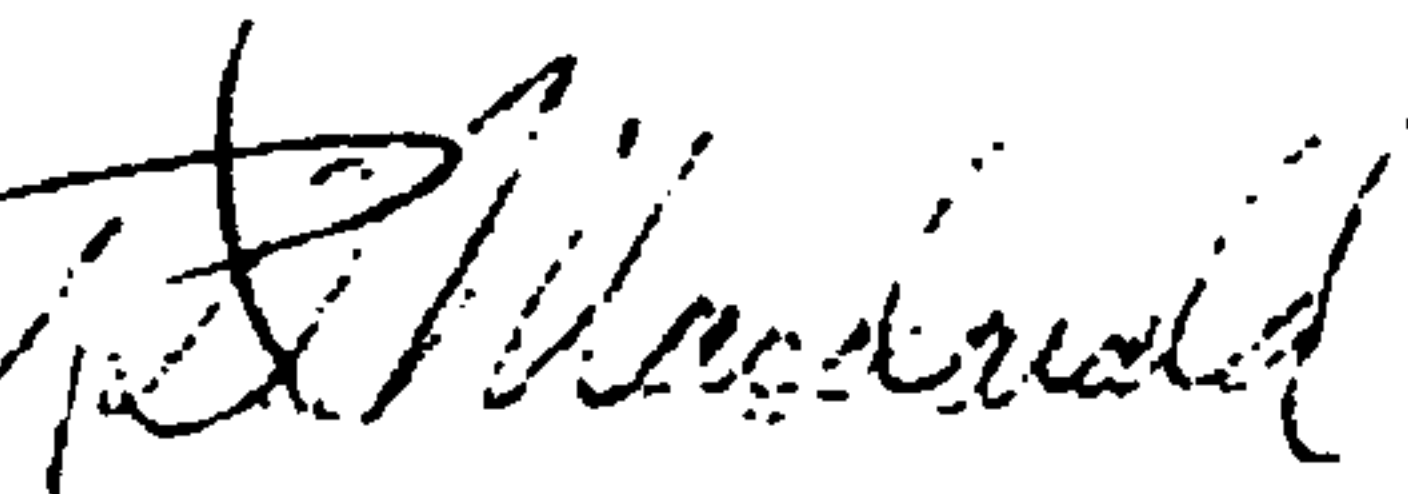
We are sending you six copies of our report "An Investigation of the Measurement and Causative Factors of Luster in Fine Particulate Talcs" by James F. Shea, Charles B. Sclar, and H. B. Kinnear.

We believe this investigation to be an important one because, although it was not an exhaustive study, strong evidence is presented that talc should be wet ground to obtain maximum luster. The study shows further that there are logical reasons why this should be true, reasons which are connected with the crumpling and deformation of talc platelets during grinding, with surface roughness, and with platelet diameter-to-thickness ratios.

The correlation of luster with method of grinding would not have been possible without the development of a positive technique for the measurement of the luster of fine particulate talc. Here again, no attempt was made to develop a highly refined method. The method as described is, however, very satisfactory for the present needs of Johnson and Johnson.

We shall welcome your comments on this report.

Sincerely yours,



R. D. Macdonald
Assistant Chief
Minerals Beneficiation Division

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Enc. (6)

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AN INVESTIGATION OF THE MEASUREMENT AND CAUSATIVE FACTORS OF LUSTER IN FINE PARTICULATE TALCS

by

James F. Shea, Charles B. Sclar, and H. B. Kinnear

SUMMARY

During the laboratory development work on the beneficiation of Italian talcs to produce a platy-talc concentrate it was continually observed that the flotation concentrates, the finished product, appeared to be considerably more "lustrous" than the unbeneficiated talcs themselves and much more "lustrous" than the products rejected by the beneficiation procedure. Insofar as the eye could perceive, the flotation products made from wet-ground run-of-mine talc appeared more lustrous than those made from the Italian No. 2 talc which had previously been dry ground in a Raymond-type mill in Italy.

In the belief that "luster" might be a valuable property and that the wet-grinding process which is a part of the Battelle-developed process might be providing an extra dividend in the way of enhanced luster, a brief research program was undertaken to determine:

- (1) Whether the phenomenon of luster, which had previously been rated visually only, could be measured instrumentally
- (2) If a satisfactory method for measuring luster could be found, whether the physical measurements would bear out the conclusions derived from visual observation, viz., that wet-grinding enhanced luster
- (3) The effect of certain chemical and physical, intrinsic and environmental factors on the luster of talc and talc products.

A survey of several methods of optical measurement indicated that the measurement of the contrast gloss of talc samples rubbed onto analytical-grade filter papers yielded numerical results which coincided well with those of visual observation. The procedure for conducting this determination, the description of the equipment, and the significance of the phenomenon of contrast gloss are dealt with in detail in this report. In brief, contrast gloss is an empirical value and is a measure of the ratio of the amount of light specularly reflected by a sample to the amount of light diffusely reflected at the same time from the same area of the sample.

Although the method tentatively prescribed lacks some refinement, it is, in the hands of a practiced operator, sufficiently precise to serve as a means for inspecting the luster of talc products.

The method was applied to a suite of samples prepared during the laboratory development work. The more significant results were:

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- (1) The contrast gloss, i.e., luster, of flotation concentrates, was considerably higher than the contrast gloss of unseparated material.
- (2) The contrast gloss of flotation concentrates made from wet-ground run-of-mine talc was superior to that of concentrates made from Italian No. 2 talc which had previously been ground to minus 200 mesh in Raymond-type mills in Italy.
- (3) The contrast gloss of flotation concentrates made from wet-ground run-of-mine talc was generally superior, although there was an exception, to that of concentrates made from the run-of-mine talc which was dry ground in a pebble mill at Battelle.
- (4) The contrast gloss of run-of-mine talc feed material and its various products excelled the contrast gloss of corresponding Italian No. 2 talc materials.

These data confirm the judgment, previously based on visual inspection, that the beneficiation process upgrades the talc significantly with respect to luster. They also point strongly to the probability that wet grinding enhances luster. This latter conclusion is not clear cut because the inferior luster of the Italian No. 2 products may be due, at least in part, to an intrinsic property of this talc; or to the possibility that, having been ground months ago, it lost luster over a period of time. Furthermore, the data on the run-of-mine talc dry ground in the pebble mill are too limited for a decisive conclusion.

An investigation into the causative factors for luster was carried through preliminary stages. This study indicated:

- (1) The most important determinant of luster probably resides in the morphology or surface characteristics and dimensions of the talc platelets. The combination of factors which seems to accompany high luster is:
 - (a) A maximum amount of platelets with level and regular surfaces
 - (b) Platelets with the largest individual areas
 - (c) Platelets with the highest ratio of area to thickness.

These factors are, of course, a function of the method of grinding. It may therefore be said that the method of grinding can be an important cause of differences in luster.

- (2) While the above factors may represent the sole causes of luster, there is a possibility, based on limited data, that luster may also be determined to some extent by chemical composition and aging.

No additional work on the luster problem is contemplated at this time.

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improvement in beneficiation procedures and to determine the correlative relationships of the physical properties of talc, it is necessary to be able to measure small differences in the physical properties and to be able to compare them to other quantitative measurements. Knowledge of these interrelationships serves as the basis for interpretation of improvement in quality and thus serves to make it possible to visualize methods of beneficiation.

Since the subjective tests are of little help in measuring small differences in one of the many physical properties encountered, and since such tests have no basis for correlation, a machine was built to measure objectively, or test for, abrasiveness, apart from other physical properties.

The Abrasion Machine

Because it was necessary to measure small differences in the abrasiveness of talc, a machine was built to test the wear effect of small concentrations of grit on standard material. The machine was built of a 1/20-hp 1725-rpm electric motor mounted vertically and fitted with a 5-inch lap covered by a Buehler Microcloth held in place by a rubber belt. The lap portion of the machine is set into a steel bowl and covered with a plastic lid. Mounted on a ringstand over the lap a 500-ml open separatory funnel with stopcock is connected by a rubber tube with an adjustable pinch clamp to a feed spout. The separatory funnel contains the sample of talc to be tested in a slurry of 3 grams of talc to 350 ml of water. The feed spout and a cylindrical pellet holder are mounted in a removable crossbar over the lap. Accessibility to these parts is afforded through a hole in the plastic cover. Standard 1/2-inch-diameter pellets are held in the sample holder by a 16.1-gram weight to prevent their skipping or floating on the lap. A 1000-ml beaker mounted under a drain in the steel bowl catches the tested slurry. Figure 1 shows the over-all apparatus. Figure 2 shows the detail of the feed and abrasion mechanism. A detailed description of the abrasion machine and the technique of its operation are found in Appendix A.

In order to measure the abrasiveness of the talc in the slurry a test had to be designed where the object abraded would have a great enough loss to be measured physically. Since the abrasiveness to be measured was that of a powder containing generally from only 1 to 3 per cent of abrasive gangue particles, the material to be abraded had to have a hardness greater than that of the talc, less than that of the grit, and also had to be coherent and homogeneous. After testing a large number of materials it was decided to perform the bulk of the tests on pellets made of minus 400-mesh Italian talc pressed under 50,000-psi pressure. The pellets average 5.20 grams and have dimensions of 1/2 by 7/10 inch. The pellets have a hardness greater than that of the raw talc and less than that of the contaminants (Table 4). Carbonate pellets were made to test specifically for the rarer, harder components, in a similar manner, but using alcohol instead of water in the slurry.

TABLE 4. RELATIVE HARDNESS OF THE TEST PELLETS AND THE GRIT PRESENT IN ITALIAN TALC

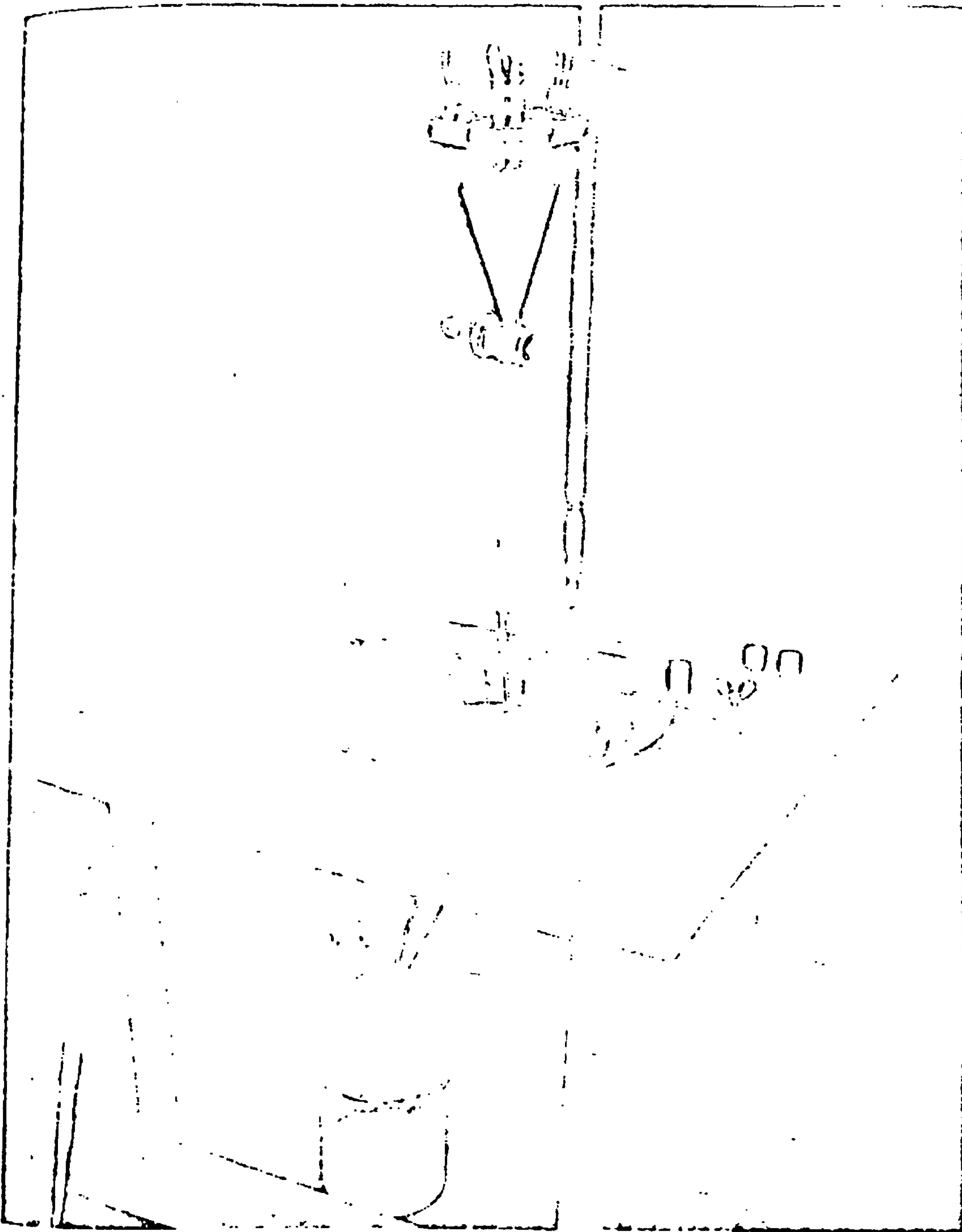
Mineral	Moh Hardness
Talc	1
Pressed-talc test pellet	± 2 (scratches talc)
Magnesite	3.5 (scratches talc pellet)
Dolomite	4
Pressed-carbonate test pellet	> 4 (scratches dolomite)
Apatite	5 (scratches carbonate pellet)
Titanite	5
Tremolite	6
Rutile	6
Zircon	7.5

The abrasion-machine operation is timed electrically. The pellets are measured on a micrometer caliper before the test and afterward, after drying. The abrasion measurement is reported in decimal fractions of an inch per second. Although there are limitations to the use of a micrometer, the samples which were compared demonstrated differences in measurement large enough to be significant. Measurements based on weight were found to be entirely unsatisfactory inasmuch as some weight loss was due to spalling and abrasion of the pellet by the walls of the sample tube on portions other than that exposed to the lap and abrasive. This indicated losses which were no indication of the degree of loss due to action on the tested surface alone.

The abrasion machine subjects the standard pellet to abrasion by the sample of talc being studied, at a high rate of speed. It has been calculated that the pellet receives wear equivalent to being rubbed over more than 1800 ft/min of surface of the talc being tested. As expected, the abrasion machine demonstrates that the slurry samples with the greater incidence of mineral contaminants produce the greater amount of abrasion on the pressed pellets. It is also shown that those samples with primarily platy habit are less abrasive than those containing effective amounts of nonplaty talc.

More precise abrasion machines could be built; however, the device used is satisfactory for the purpose of comparing samples within the range of those tested and is an adequate means of obtaining comparable measurements of the effect of grit. Typical figures obtained by the abrasion experiments are shown in Table 5.

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FIGURE 1. THE ABRASION MACHINE SHOWING RESERVOIR CONTAINING
SAMPLE IN SLURRY TO BE TESTED FOR ITS ABRASIVENESS

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FIGURE 2. DETAIL VIEW OF ABRASION-MACHINE LAP SHOWING FEED SPOUT, CYLINDER IN WHICH PELLETS
ARE HELD ON THE LAP, AND STANDARD PELLETS OF PRESSED TALC

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PRELIMINARY WORK TO DEVELOP A SUITABLE
METHOD FOR MEASURING LUSTER

Preparation of a Set of Visually Rated Luster Standards

As a first step in the development of a method for measuring luster, a series of talc samples was prepared and submitted to individual observers who were asked to rate them according to their luster. In most cases, it was stated to the observers that luster did not necessarily imply whiteness or brightness; but was analogous to sheen, gloss, shininess, etc. No specific method for judging luster was suggested and no specific rating code was prescribed.

The results of this survey are shown in Table 1. The samples examined are listed in the left-hand column of the table and are described in footnotes. Each vertical column thereafter presents the ratings by the individual observers. The ratings are expressed numerically; the lower the number the higher the luster.

Some of the observers used a numerical system for grading the talc; most did not. For example, one employed such categories as "best", "next best", "poor", and "no good" (Observer E). For presentation in the table, these particular categories have been expressed as 1, 2, 3, and 4, respectively. Another observer (H) divided the samples into two groupings, "lustrous" and "inferior". These have been expressed as 1 and 2, respectively, in the table.

No observer attempted to distinguish between individual samples but reported his findings in groups. For example, Observer A listed Samples V, P, T, U, and L-7 as having the highest luster, with Samples M and Q in second place, Samples Y, S, and W in third, Sample W-2 in fourth, and Samples Z, X, and R in last. Observer B did select Sample V alone as being the most lustrous, but divided the remaining samples into groups.

The results indicate that:

- (1) Samples V, P, T, and U were almost unanimously judged to be the most lustrous.
- (2) Samples W, Q, S, M, and L-7 were judged by most observers to possess an intermediate luster.
- (3) Samples Y, Z, X, R, and W-2 were rated as having the least luster.

Physical Measurement of the Luster Standards

With this suite of samples, visually rated for luster, the research effort was next directed toward determining whether any of the available methods of optical measurement would yield results that coincided with those of visual observation. The methods tried are discussed in the following sections.

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an empirical quantity that has been found useful in determining the relative gloss of low-gloss papers and, reportedly, yields data which agree with those of visual observation. The results of the contrast-gloss measurement of the samples prepared in the manner described, were somewhat promising, in that all of the samples visually judged to possess the highest luster yielded contrast-gloss values in the highest range. There were, however, some anomalies in the results on the intermediate- and low-luster samples. Several of these judged visually to be almost chalky, exhibited high contrast-gloss values on the reflectometer. These were, notably, cyclone-overflow products, which were extremely fine. It was concluded that this method would not be satisfactory, not only because of the few anomalies but also because the sensitivity of the method was poor, i. e., the spread in readings between high-luster and low-luster material was quite small. The results are also shown in Table B-1 in Appendix B.

Contrast Gloss of Thin, Oriented Talc Surfaces

Contrast-gloss measurements were then made on samples rubbed onto filter paper, using the Gardner Multipurpose Reflectometer. The procedure of rubbing the talc onto filter paper was suggested by the practice employed by most observers in judging luster, which was to rub the talc onto their skin and to observe its reflectance at various angles. The results of these measurements agreed very closely with those of visual observation. Moreover, reasonably wide-spread readings existed between the readings for high-luster and for low-luster materials. The results are shown in Table B-1 in Appendix B.

PROCEDURE DEVELOPED FOR MEASURING THE CONTRAST GLOSS OF TALC SAMPLES

The procedure tentatively adopted for determining contrast gloss on talc samples is as follows:

Approximately 2 grams of talc are poured onto the center of a 12.5-centimeter Whatman No. 41-H filter paper. The talc is rubbed onto the paper with the middle finger or several fingers in a circular motion. The pressure applied in rubbing is approximately one-half pound as determined by preparing a sample on the pan of a laboratory beam balance. In rubbing the talc onto the paper, care should be taken to ensure that the finger is always moving excess talc about the surface. Experience has shown that unless excess talc is available, the rubbing action removes some talc that has already been aligned on and embedded in the surface and leads to lower contrast-gloss values. From 15 to 20 circular strokes are employed in rubbing.

The excess talc is poured from the paper back into the sample container, the paper is given a slight, sudden flick by a wrist movement and the surface is blown on gently to remove extremely fine talc. The flicking and blowing steps are necessary to ensure maximum reproducibility of results. If they are not used, contrast-gloss measurements may be low and erratic. The reason for this is not known for certain, but it is believed that rubbing alone without flicking or blowing results in a surface of properly oriented particles of talc but one in which fine unoriented particles lie on top of the oriented particles.

Specular Gloss

Specular gloss measurements were made on portable gloss meters of the kind commonly used to determine the gloss of painted surfaces. These measurements were made on bulk material contained in a shallow mold. The sample was lightly compacted, smoothed and leveled, by drawing a piece of plate glass across the surface. The specular gloss of the samples, thus prepared, was measured at three different angles of incidence and corresponding reflectance; 20°, 60°, and 85°. The method proved unsatisfactory because even those samples which had been judged visually to be the most lustrous gave readings of only 1 to 2 on the 100-unit scale.

Reflectance

Luminous apparent-reflectance measurements on bulk materials prepared as described above were made with the Gardner Multipurpose Reflectometer*. These measurements are approximately the same as the Rd measurements obtainable by the Gardner Color Difference meter which has been used in the previous work on talc.

There was no correlation between the luminous apparent-reflectance data and the results of the visual luster-ratings of the samples. The data for the luminous apparent-reflectance measurements are shown in Table B-1, Appendix B.

Whiteness and Yellowness

Reflectance measurements were also made through tristimulus filters (i. e., reflectance with green, blue, and amber light) on samples prepared as above, using the Gardner Multipurpose Reflectometer**. From the data thus obtained, numerical expressions of whiteness and yellowness were calculated. Whiteness could not be correlated with the results of visual judgment. There was an apparent correlation in some instances with yellowness. Some of the more lustrous samples were, by the numerical convention, more yellow than less lustrous samples. However, the correlation was otherwise poor. It is believed that the yellowness of the more lustrous samples has been caused by some factor associated with the processing of the talc and is completely independent of the intrinsic optical characteristics of the crystals. Table B-1 in Appendix B shows the results of the measurements made with tristimulus filters and the derived whiteness and yellowness values.

Contrast Gloss of En Masse Samples

Contrast-gloss measurements on samples prepared as above (i. e., by dusting samples into a shallow mold and leveling and smoothing the surface by drawing a piece of plate glass across it) were made with the Gardner Multipurpose Reflectometer***. The contrast-gloss measurement on this machine is, in effect, specular reflectance divided by diffuse reflectance and is obtained by simultaneously measuring specular reflectance at +45, -45°, and diffuse reflectance at +45, 0°, with a green filter. It is

*See Appendix A, Item 1, for a description of the instrument and the procedure for determining reflectance. See also Item 2, page 611, for a discussion of the luminous apparent-reflectance measurement.

**Appendix A, Item 1, also Item 2, page 612.

***See Appendix A, Item 1, page 6, and Item 2, page 614 for discussion of the contrast-gloss measurement.

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As the procedure is applied in the Battelle laboratory the filter paper retains about 0.2 to 0.3 gram of talc. After the blowing step, the filter paper is placed on top of a stack of 10 or more 41-H papers which serve as a cushion and a light barrier. The 41-H paper is sufficiently translucent, so that if only a few are used somewhat erratic results will be obtained. Contrast gloss is determined as described on page 5, Item 1, in Appendix A.

Four measurements are made on each sample. After the first measurement, the paper is rotated approximately 90° and an additional reading is made. This is repeated twice more at 90° intervals. The four readings are averaged and the average is reported as the contrast-gloss value for the sample. Because no absolute standard is available, the Reflectometer is adjusted prior to running the samples so that when 41-H filter paper alone is used, the readings fall in the range between 1.40 and 1.44. Alternatively, the instrument may be adjusted so that the special ceramic plaque provided with the particular Battelle instrument will give a contrast-gloss reading of 1.82*.

Precision of the Contrast-Gloss Measurement

Table 2 presents data illustrating the precision of the method. Three groupings of data are shown in the table. The first two groups show the results obtained by a single operator who made five consecutive determinations according to the tentatively prescribed method on a talc sample with an intermediate contrast gloss and on one with a contrast gloss in the high range. As shown in the table, the individual readings exhibited a fairly wide spread. In the measurement of the sample with intermediate gloss, the readings obtained ranged from 1.46 to 1.51. It is Battelle's opinion, although it has not been firmly substantiated, that such divergence in the individual readings is legitimate and that it reflects actual differences in contrast gloss in the various areas of the sample being examined. It is entirely conceivable that the relatively crude technique of rubbing talc onto the filter paper and of eliminating excess talc by flicking and blowing does not result in a surface homogeneous with respect to contrast gloss. The average of the four individual readings probably is the fairest way to report the contrast gloss of a given sample. It has also been found that the average of four readings on a properly prepared sample does not deviate significantly from an average of 20 or more readings.

The agreement between the average results of each of the five determinations made on the sample with intermediate luster was reasonably good. The average deviation from the mean for these five samples was 0.011. The probable error calculated from this value is 0.007 and the reasonable limit for reporting determinations of contrast gloss on talc samples with intermediate gloss is calculated to be ± 0.02 .

On the five determinations shown in the second grouping in the table made on the talc sample with the higher contrast gloss, the spread in individual readings was considerably greater than on the talc sample with intermediate contrast gloss. Calculations based on these data indicate that the probable error of a single determination of contrast gloss of such samples is 0.011 and that it is reasonable to report results as ± 0.03 .

*After this report was in preparation, the Sponsor requested Battelle to investigate the possibility of obtaining primary standards for contrast gloss which could be used to standardize the measurement and permit interlaboratory check determinations on different instruments. It was not until the report was completely reproduced that satisfactory standards were obtained. See Appendix E for an account of the acquisition of the standards, the results of a limited number of contrast-gloss measurements made on the reflectometer after it had been adjusted to give readings consistent with the standards, and for the significance of the standardization of the measurement.

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- (2) Working standards for contrast gloss should be calibrated on a goniophotometer*. Only with such standards can a close degree of accuracy be assured. Such a standard was not prepared for this study, recognizing that internally consistent data would suffice for the purpose of comparing one talc with another and further recognizing that the effects of any refinement to impart accuracy would be vitiated by the effect of the filter-paper backing.

Accordingly, the contrast-gloss data are not accurate, if one defines accuracy as agreement with objective truth. At best, and this is sufficient for the aims of the study, the method for determining contrast gloss may be likened to measuring with a yardstick on which the graduations begin at x and run $x + 1$, $x + 2$, etc.

Possibility of Refining the Method

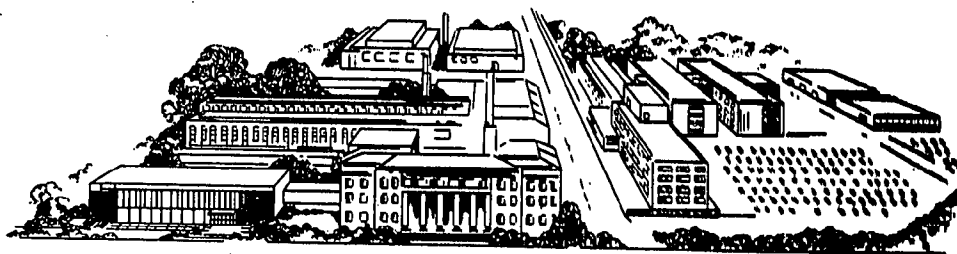
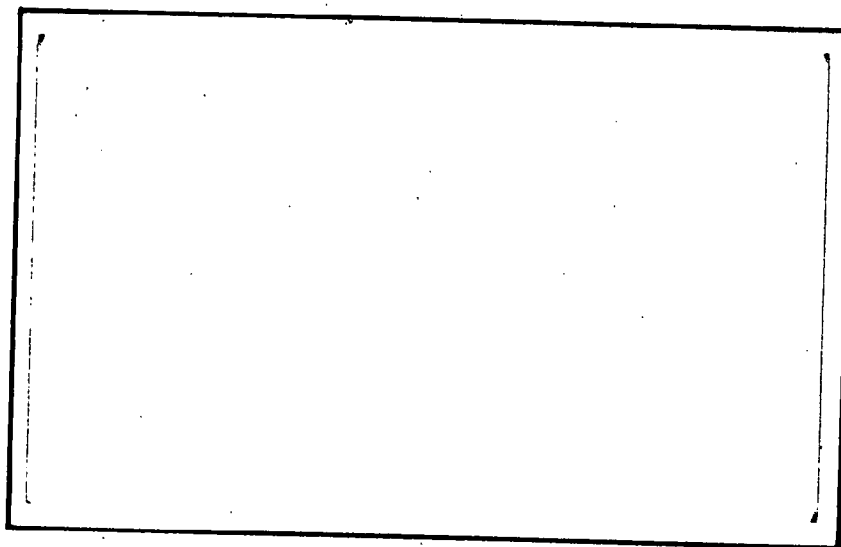
The most outstanding apparent weakness of the prescribed method is in the manner in which the talc surface is applied to the filter paper, i. e., by rubbing, flicking, and blowing. Two alternative methods were investigated. In the first of these, the talc was applied to the paper by means of so-called coating rods which are commonly used in ceramic laboratories to apply even coatings of ceramic slurries to surfaces. A coating rod consists of a stainless steel rod, tightly and closely wound with very fine stainless steel wire. In using it, one sets the rod horizontally at one edge of the surface to be coated, applies an excess of the coating material across the surface, and adjacent to the rod, and then applying slightly downward pressure evenly draws the rod through the material. This technique did not work for preparing talc surfaces. The readings for contrast gloss obtained on samples thus prepared were erratic and considerably lower than those obtained on the same samples prepared as prescribed in the method. It is probable that the coating rods which work well with ceramic slurries as a means for obtaining a uniform coating are unsatisfactory for use with dry materials and do not coat the surface completely. This would account for erratic results. It is also probable that the technique of drawing the wire-wound rod across a surface of talc fails to orient the talc particles as well as does the rubbing action with the fingers. This would account for the low contrast-gloss data obtained.

One method of applying the talc that showed some promise was one in which the talc was slurried in alcohol and then poured onto the paper, set in a vacuum filter funnel. The alcohol was filtered off and the paper dried by suction. In many cases, the readings for contrast gloss on samples prepared in this manner agreed closely with those prepared according to the prescribed method. In many other cases, results were erratic, probably because the action of pouring a slurry onto the paper did not necessarily result in an evenly spread properly oriented bed of talc, and also possibly because in handling the dried filter paper, the talc, which is apparently less firmly embedded by filtration than when applied by rubbing, became dislodged. With additional work, this filtration method might be developed into a more scientifically acceptable procedure for applying talc to filter paper than the rubbing method. Because the rubbing method was much faster and yielded apparently satisfactory results, such development work was not considered justifiable at this stage of the program.

*Appendix A, Item 2, page 614.

Exhibit 42

RESEARCH REPORT



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BATTELLE FIELDS OF RESEARCH

AERONAUTICAL ENGINEERING	INSTRUMENTATION
AGRICULTURAL CHEMICALS	LIGHT ALLOYS AND RARE METALS
ALLOY DEVELOPMENT	LUBRICANT TECHNOLOGY
ANALYTICAL CHEMISTRY	MECHANICAL ENGINEERING
APPLIED MATHEMATICS	METAL FINISHING
BIOCHEMISTRY	METALLURGICAL PROCESSES
BIOPHYSICS	MINERALOGY AND MICROSCOPY
BUILDING AND ENGINEERING MATERIALS	MINERALS PROCESSING
CATALYSIS AND SURFACE CHEMISTRY	MICROBIOLOGY
CERAMICS	NONFERROUS METALLURGY
CHEMICAL ENGINEERING	NUCLEONICS
CHEMICAL PROCESSES	OPERATIONS RESEARCH
CORROSION TECHNOLOGY	ORGANIC CHEMISTRY
COMPUTER ENGINEERING	ORGANIC COATINGS
ECONOMICS	PETROCHEMICALS
ELECTRICAL ENGINEERING	PETROLEUM ENGINEERING
ELECTROCHEMICAL ENGINEERING	PHYSICAL CHEMISTRY
ELECTROCHEMISTRY	PHARMACEUTICAL CHEMISTRY
EXTRACTIVE METALLURGY	PRODUCTION ENGINEERING
ELECTRONICS	PULP AND PAPER TECHNOLOGY
FERROUS METALLURGY	RADIOISOTOPES AND RADIATION
FOUNDRY PRACTICE	RELIABILITY ENGINEERING
FOOD TECHNOLOGY	REACTOR TECHNOLOGY
FUELS AND COMBUSTION	REFRACTORIES
GRAPHIC ARTS TECHNOLOGY	RUBBER AND PLASTICS
GLASS TECHNOLOGY	SEMICONDUCTORS AND SOLID-STATE DEVICES
HIGH TEMPERATURE METALLURGY	SYSTEMS ENGINEERING
HUMAN ENGINEERING	TEXTILES AND FIBERS
IMMUNOLOGY AND CANCER STUDIES	THEORETICAL AND APPLIED MECHANICS
INDUSTRIAL PHYSICS	THERMODYNAMICS
INFORMATION PROCESSING	WELDING AND METALS-JOINING TECHNOLOGY
INORGANIC CHEMISTRY	WOOD AND FOREST PRODUCTS

PROGRESS REPORT

on

THE PHYSICAL CONCENTRATION OF
TALC ORES - FLOTATION OF ITALIAN
RUN-OF-MINE TALC

to

JOHNSON AND JOHNSON

December 31, 1959

by

Whitman E. Brown

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio

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Battelle Memorial Institute

5 0 5 K I N G A V E N U E C O L U M B U S I , O H I O

January 15, 1960

Mr. W. H. Ashton
Research Department
Johnson and Johnson
New Brunswick, New Jersey

Dear Mr. Ashton:

We are sending you six copies of our report on "The Physical Concentration of Talc-Ores - Flotation of Italian Run-of-Mine Talc", by Whitman E. Brown. This report, in conjunction with our similar report of July 31, 1959, on the "Flotation of Italian No. 2 Talc", gives the laboratory work that was the basis for the recommendation of a pilot talc-flotation plant and the data on which its design was based.

Sincerely yours,


O. F. Tangel

OFT:jvo

cc: Dr. W. H. Lycan
C. W. Swank

DEDICATED TO THE ADVANCEMENT OF SCIENCE

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PROGRESS REPORT

on

THE PHYSICAL CONCENTRATION OF TALC ORES -
FLOTATION OF ITALIAN RUN-OF-MINE TALC

to

JOHNSON AND JOHNSON

from

BATTELLE MEMORIAL INSTITUTE

by

Whitman E. Brown

December 31, 1959

INTRODUCTION

This is the Third Progress Report on "The Physical Concentration of Talc Ores" and specifically applies to experimental results obtained from the beneficiation of Italian run-of-mine (ROM) talc. For comparative purposes, occasional references are made in the discussion about results obtained from Italian No. 2 talc.*

The objectives of the investigation were:

- (1) To obtain a product that consists essentially of talc platelets
- (2) To reject talc particles that are of a size and shape that create unpleasant dusting while talc is being dispensed from a container
- (3) To obtain a talc product with an obvious luster in order to convey to the consumer the immediate impression that the talc is of the highest quality
- (4) To investigate the variables that affect the grindability of talc

*Brown, W. E., "The Physical Concentration of Talc Ores - Flotation of Italian No. 2 Talc", Battelle Progress Report to Johnson and Johnson (July 31, 1959).

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- (5) To establish that the beneficiation process developed for Italian No. 2 talc is also applicable to the run-of-mine talc.

In addition to achieving the foregoing objectives, it was desirable that the finished talc product meet the following specifications:

Moisture: Not more than 0.15 per cent

Solubility in HCl: Not more than 6 per cent

Fineness: Not less than 99.7 per cent through a 100-mesh Tyler sieve and not less than 98.5 per cent through a 200-mesh sieve

Microscopic Structure: Platelets, and no acicular or excessive granular crystals

Bulk Density: Not less than 22 nor more than 27 pounds per cubic foot, when tested by the Scott Volumeter.

In further keeping with the standards of production, it is desirable that the finished talc product have essentially the same whiteness as that currently being marketed by Johnson and Johnson.

The methods of beneficiation employed in previous work were hydraulic cycloning and flotation. It was established in the earlier investigations that hydraulic cycloning alone not only rejected objectionable dust-forming particles, but also improved the platy content of the talc. However, cycloning alone was not sufficient to obtain the ultimate in purity. Flotation proved to be effective for the removal of more nonplaty talc, tremolite, dolomite, and other accessory gritty and off-color minerals. The combined cyclone-flotation processes developed for Italian No. 2 talc were not effective in improving the luster, as judged by casual observations, although the mineral particles were 98 to 99 per cent talc platelets. If a product consisting of such high-purity mineral particles did not have an improved luster, then a method of comminution, other than roller milling, might affect favorably the morphology of the platelets and the luster. Wet and dry pebble milling seemed logical methods to try.

In addition to obtaining a talc with an improved luster, certain economic factors had to be considered. It was the Sponsor's desire to remove from talcum powder objectionable dust-forming particles: platelets or other forms. Some experiments indicated that particles finer than 10 or 15 microns were easily airborne and, therefore, their removal should improve the powder. Size-distribution experiments, however, showed that about 27 per cent of the Italian No. 2 type of talc was finer than 10 microns and about 40 per cent of the weight was finer than about 14 microns, so that complete rejection of the potential dust, in the final analysis, would

increase the total cost of the raw material in direct proportion to the amount of rejected weight. This does not include the operating cost of the classification process. Battelle believed that carefully controlled wet- pebble-mill grinding might result in a ground product having less of the objectionable fine sizes. Johnson and Johnson was asked to obtain Italian run-of-mine (unground) ore samples, so that the problems related to luster and fine grinding might be investigated in the laboratory.

SUMMARY - ITALIAN ROM TALC

Batch wet grinding in a laboratory pebble mill produced fine-ground talc that had a higher order of luster than that obtained by dry roller milling or dry pebble milling.

Batch wet pebble milling resulted in faster grinding of minus 10-mesh talc through 200 mesh but produced more objectionable fine talc in the minus 10-micron sizes than batch dry pebble milling.

Variables that affect rates of grinding were investigated. It was found that a grinding time of less than 11 minutes and a circulating load of more than 336 per cent may be required to avoid overgrinding. Laboratory experiments were not successful in obtaining a ground product containing less than 35 per cent of the weight finer than 10 microns. Data were obtained, however, that can be used to determine the approximate grinding time necessary to obtain the desired results. This information is discussed with Figure 5 in the "Grinding" section of this report.

It is necessary to grind finer than 100 mesh, because a 100-mesh grind yields products that are gritty, although the high luster is remarkably evident.

If the ROM talc is overground, that is, contains more than about 40 per cent of minus 10-micron particles, one stage of cyclone classification may not be sufficient for satisfactory removal of the fines. However, ROM talc which has not been overground responds satisfactorily to cyclone classification.

Flotation of wet-ground and classified ROM talc was successful. Beneficiated products were obtained that were 97 to 99 per cent platy talc. The yield expected in a continuous operation is 80 per cent of the weight of the flotation feed; this amounts to 56 per cent of the original ore.

The beneficiated talc was an improvement in all respects when compared with the Johnson and Johnson specifications for the raw material currently used in their marketed Baby Powder.

The beneficiation process developed for Italian No. 2 talc is also satisfactory for Italian ROM talc when the proper crushing and grinding equipment are used.

SAMPLING AND MINERAL EVALUATION OF ITALIAN ROM TALC

Johnson and Johnson arranged for a sample of coarse run-of-mine (ROM) Italian talc to be shipped to Battelle for grinding and flotation experiments, including luster studies of the products from the experiments. Approximately 4,450 pounds of ROM ore were received for this work in July, 1958. One bag containing 150 pounds of talc was reserved for miscellaneous purposes. The remaining portion, containing some pieces up to 1-1/2 inches maximum dimension, was mixed by coning and reduced in quantity by riffing to 268 pounds. The 268-pound sample was roll crushed through a 10-mesh Tyler screen for feed material in the grinding (pebble-milling) experiments. A small but representative portion of the minus 10-mesh talc was ground in a pebble mill to pass through a 200-mesh Tyler screen and examined with a microscope.

Results of the microscope analysis showed that the Italian ROM talc was almost identical to the Italian No. 2 talc in mineral composition. It contained about 90 per cent platy talc, 6 per cent nonplaty talc, 2 per cent dolomite, and 2 per cent tremolite. The Italian No. 2 talc contained about 90 per cent platy talc, 6 per cent nonplaty talc, 3 per cent dolomite, and 1 per cent tremolite.

Because of the nearly identical mineral compositions of the ROM talc and the Italian No. 2 talc, it was implied that beneficiation methods developed for Italian No. 2 material would probably be just as effective for the processing of ROM talc.

EXPERIMENTAL WORK

Grinding

The objectives for grinding ROM talc were threefold:

- (1) Grind the ore through 200 mesh in a manner that would result in the production of less minus 10-micron talc than that contained in Italian No. 2 talc, or significantly less than about 27 per cent

- (2) Grind the ore in a manner that would result in a ground product having a more prominent luster than that obtainable from Italian No. 2 talc
- (3) Determine the most expedient method of grinding to produce ground products suitable for subsequent classification and flotation experiments in the laboratory.

Because talc is one of the softest natural minerals, one might expect that it would grind easily and overgrinding would be difficult to avoid.

Preliminary experiments on wet grinding minus 10-mesh talc through 200 mesh indicated that grinding of talc was not so simple as grinding the granular type of minerals.

The reasons are that (1) talc resists grinding because of its lubricity and (2) the high specific surface of liberated talc platelets per unit of weight fixes the maximum grinding density of the slurry at about 45 per cent solids. If the slurry density is increased a few per cent beyond this point, it becomes a sticky paste, which is an impracticable condition for grinding.

Because of the unusual grinding characteristics of talc, specifically the Italian type, it became necessary to determine what conditions would be required to grind efficiently and what variables have the most influence on the desired results.

A program for grinding experiments was established to investigate the influence of certain variables on the efficiency in producing minus 200-mesh talc. The variables investigated were:

- (1) Effect of weight of talc charged to pebble mill in wet and dry grinding
- (2) Effect of grinding-media weight
- (3) Effect of grinding time
- (4) Effect of pulp density
- (5) Effect of pebble size.

The pebble mill used for these experiments is made of porcelain with inside dimensions of 7-1/2-inch diameter and 7-1/4 inches long. It was rotated at 70 rpm.

Effect of Weight of Talc Charged to Pebble Mill in Wet and Dry Grinding

Figure 1 shows the effect of the weight of talc charged to the pebble mill on the per cent of talc reduced to minus 200 mesh.

There are two prominent characteristics evident from the data plotted in Figure 1.

- (1) Wet grinding is more effective than dry grinding in reducing the particle size of talc to finer than 200 mesh.
- (2) The percentage of talc reduced to 200 mesh and finer decreases at a constant rate with an increase in the amount of talc charged to the pebble mill.

The data show that, with a charge of 120 grams of talc, which is about 24 per cent of the nominal mill capacity, about 91 per cent of the charge was reduced to 200 mesh in a grinding time of 60 minutes. If, however, the charge is increased to 240 grams, or about 48 per cent of capacity, the amount of talc that is reduced to 200 mesh is about 73 per cent. Finally, if the talc charge is increased to 500 grams, a 60-minute grind will reduce 35 per cent of the charge to 200 mesh.

Dry-grinding characteristics are similar to wet-grinding characteristics with respect to rate of change in grinding with increased loading. However, when a 120-gram charge of talc was wet ground for 60 minutes, about 91 per cent of the slurry was finer than 200 mesh. After dry grinding the same weight of charge, only about 71 per cent of the resulting powder was finer than 200 mesh.

The data plotted in Figure 1 do not immediately reveal all of the facts. Actually, the amount of minus 200-mesh material produced reached a peak when a charge of 400 grams was wet ground or dry ground. The following tabulation of grinding data illustrates this point.

Weight of - 10 Mesh Talc Charge, grams		Per Cent of Charge Ground Finer Than 200 Mesh		Total Weight of Charge Ground Finer Than 200 Mesh, grams	
<u>Wet</u>	<u>Dry</u>	<u>Wet</u>	<u>Dry</u>	<u>Wet</u>	<u>Dry</u>
120	120	90.6	70.5	108.7	84.6
240	240	73.0	59.0	175.2	141.6
400	400	52.7	42.0	210.8	168.0
500	500	39.0	32.0	195.0	160.0

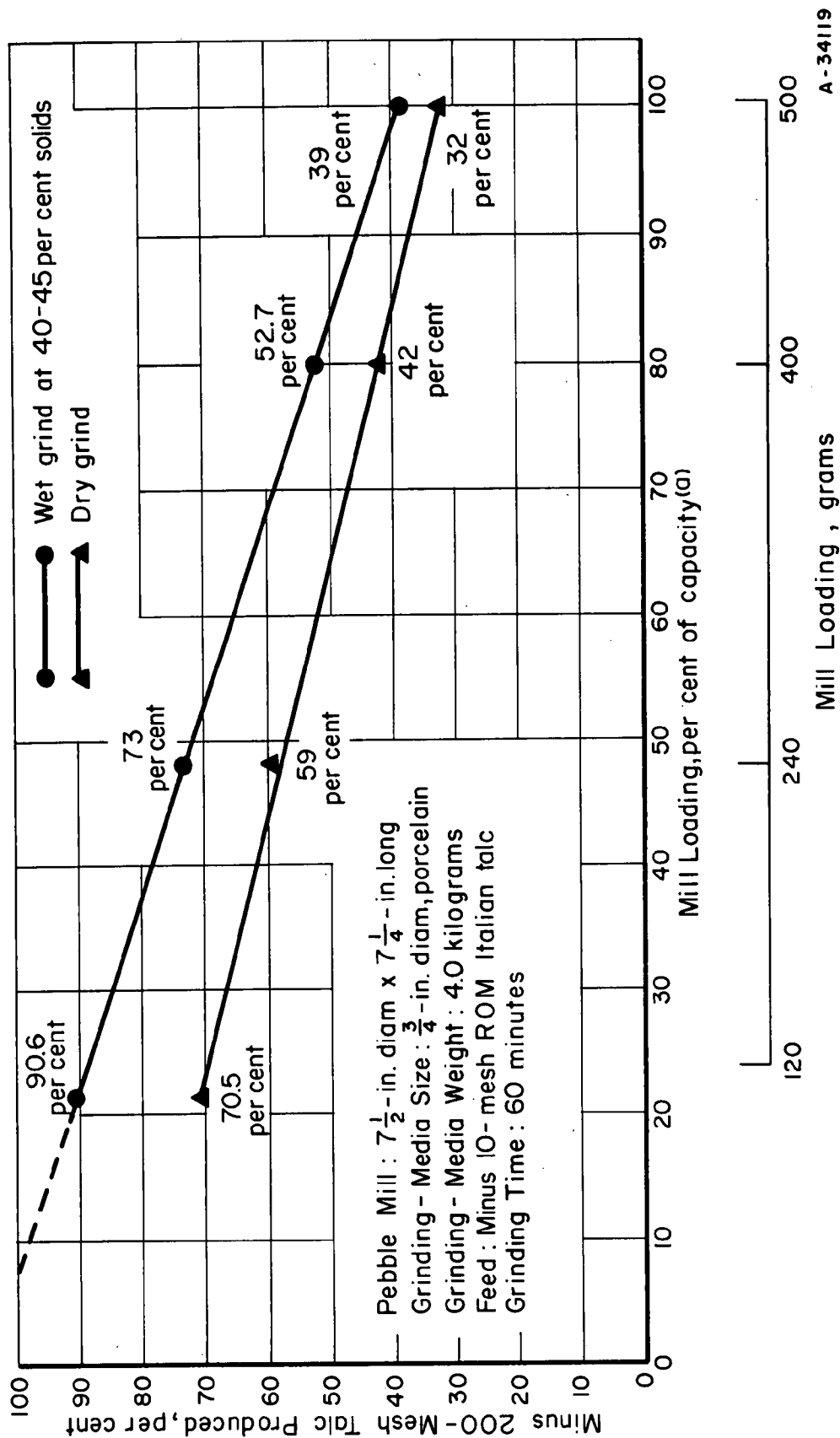


FIGURE 1. THE EFFECT OF THE WEIGHT OF TALC CHARGED TO THE PEBBLE MILL ON THE PER CENT OF TALC REDUCED TO MINUS 200 MESH

(a) Pebble-mill capacity considered to be 500 grams.

Effect of Grinding-Media Weight

Figure 2 shows the effect of the weight or volume of grinding media on the per cent of talc reduced to minus 200 mesh. The curve shows that, as the weight of grinding media was increased from 2.5 kilograms, or about 31 per cent of the mill volume, to 5.0 kilograms, or about 62.5 per cent of the mill volume, the amount of talc that was reduced to 200 mesh was increased from 70 per cent to about 95 per cent. The increased rate of grinding is pronounced as the amount of grinding media is increased up to 50 per cent of the mill volume. Increasing the grinding media in excess of 50 per cent of the mill volume resulted in small increases in producing additional amounts of minus 200-mesh talc. Furthermore, it is not possible to have more than 50 per cent of the mill volume occupied by grinding media in a continuous operation.

Effect of Grinding Time

The next series of experiments were made to determine the effect of grinding time on the amount of talc reduced to 200 mesh. These experiments were made by wet and dry grinding 120-gram charges of minus 10-mesh talc over a range of 15 to 90 minutes.

The data obtained from these experiments are plotted in Figure 3 and show that, as the wet-grinding time is increased from 15 to 60 minutes, the amount of talc reduced to 200 mesh is increased from 50 to 90 per cent. Grinding in excess of 60 minutes resulted in only minor increases in the amount of minus 200-mesh talc produced and appears impractical. Figure 3 also shows that wet grinding is more effective than dry grinding. Although the wet- and dry-grinding curves tend to parallel each other, wet grinding produced from 15 to 30 per cent more 200-mesh material for any given grinding period.

Effect of Pulp Density

Previous experiments established that, when a large percentage of the talc is ground finer than 200 mesh, pulp densities near or in excess of 45 per cent solids resulted in a pasty, nonfluid mass. Experiments were made on grinding 120 grams of minus 10-mesh talc charges at 30, 35, 40, and 45 per cent solids. The resulting data are plotted in Figure 4 and show a gradual increase in grinding efficiency as the per cent solids of the slurry is increased from 30 to 45 per cent. At 30 per cent solids, about 72 per cent of the talc was ground through 200 mesh, and at 45 per cent solids the ground product was about 91 per cent minus 200 mesh.

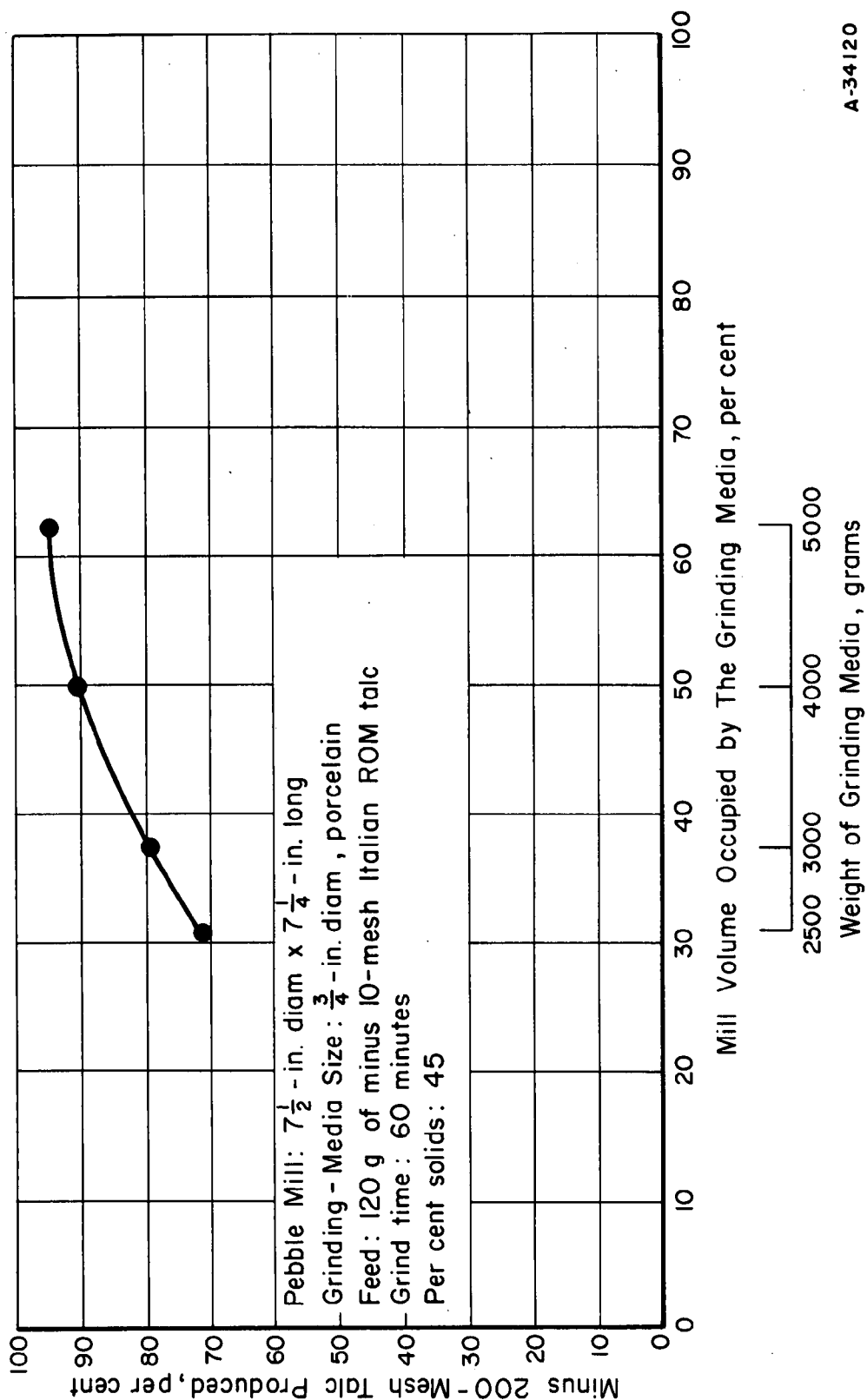


FIGURE 2. THE EFFECT OF THE WEIGHT OR VOLUME OF GRINDING MEDIA ON THE PER CENT OF TALC REDUCED TO MINUS 200 MESH

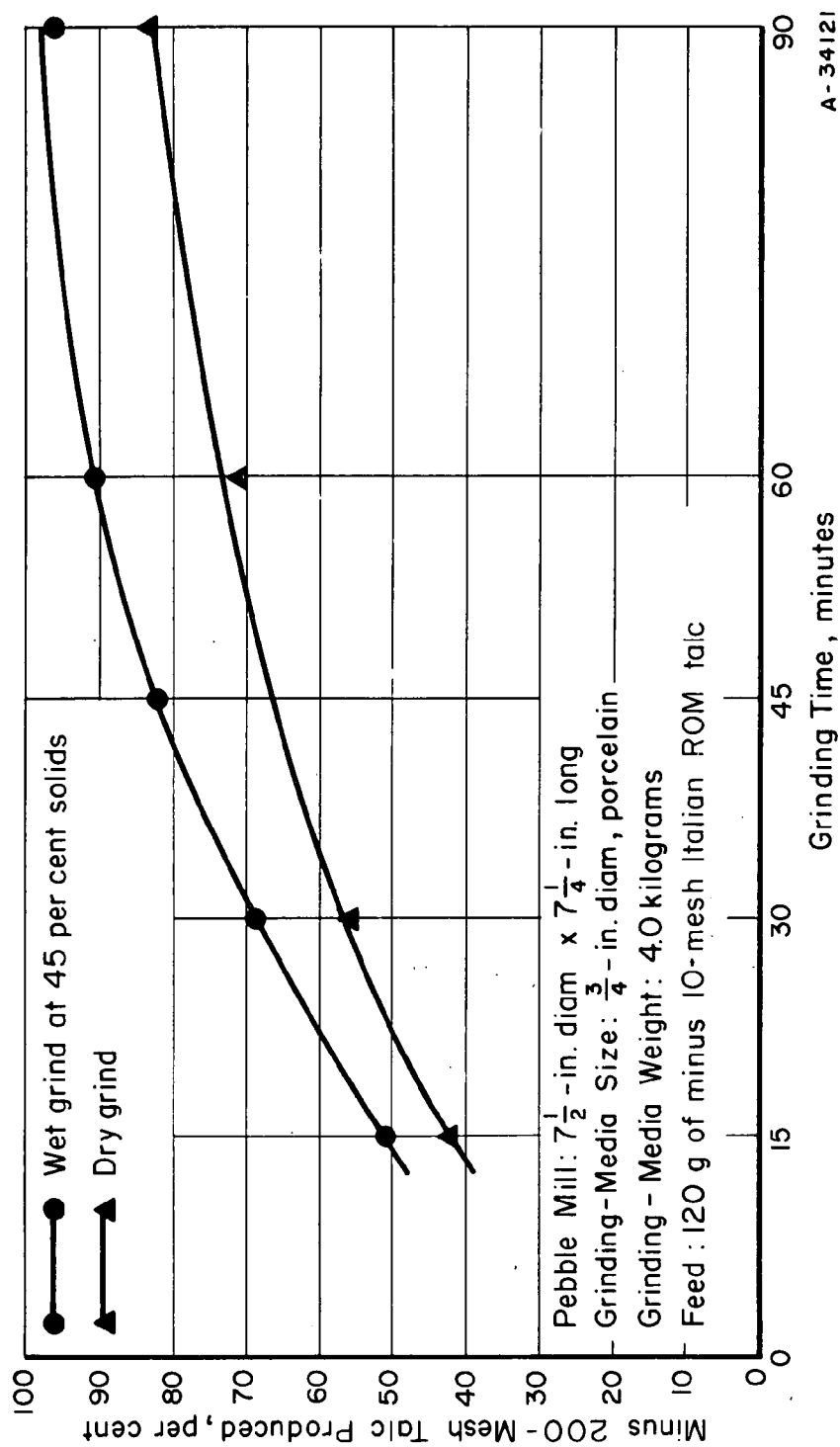


FIGURE 3. THE EFFECT OF GRINDING TIME ON THE PER CENT OF TALC REDUCED TO MINUS 200 MESH

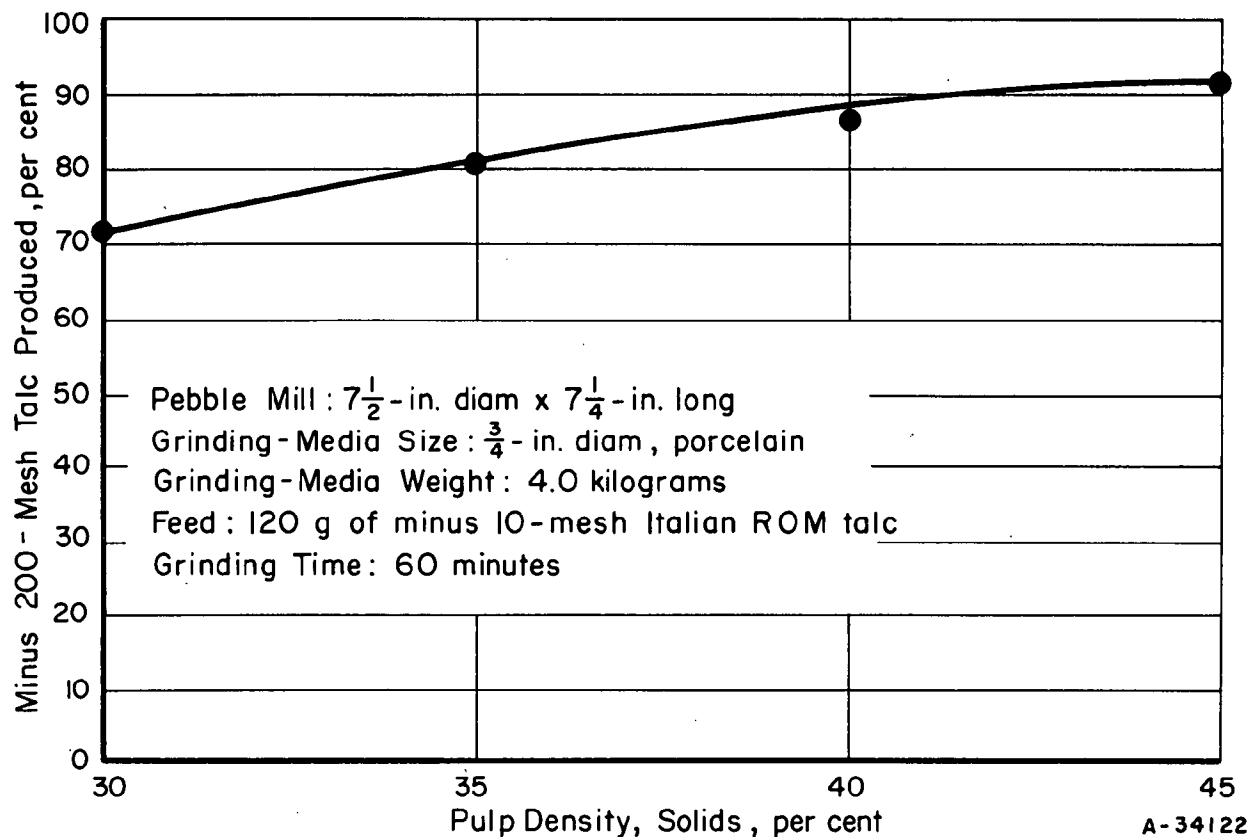


FIGURE 4. THE EFFECT OF THE PULP DENSITY DURING GRINDING ON THE PER CENT OF TALC REDUCED TO MINUS 200 MESH

Effect of Pebble Size

This part of the investigation was limited to pebble sizes of 0.75-inch diameter, 1.5-inch diameter, and a mixture of the two. Experiments were made using 120 grams of minus 10-mesh talc charges adjusted with water to 45 per cent solids and ground for 60 minutes.

The following tabulation gives the data obtained from this work:

<u>Size of Pebbles, inches</u>	<u>Weight of Pebbles, kilograms</u>	<u>Minus 200-Mesh Talc Produced, weight per cent</u>
0.75	4.0	90.6
0.75 and 1.50(a)	4.0	88.5
1.50	4.0	86.8

(a) About 50 per cent of each size.

These data show that small-diameter pebbles will grind more talc through 200 mesh than large-diameter pebbles in a given length of time. Four kilograms of 0.75-inch pebbles reduced 90.6 per cent of the 120-gram talc charge through 200 mesh. The same weight of 1.5-inch pebbles reduced 86.8 per cent of the charge through 200 mesh.

Effect of Grinding Time on Production of
Minus 10-Micron Particles

In the foregoing discussion about the various factors involved in grinding, no effort was made to determine the amount of minus 10-micron talc produced. This was partly because optimum grinding conditions were not known and also because it was planned to combine the most effective grinding conditions and run a series of experiments, using time as the only variable, and obtain more complete size-distribution data. The following grinding conditions were selected as desirable:

Weight of Pebble Charge	4.0 kilograms
Size of Pebbles	0.75 inch
Weight of Talc to Be Ground	120 grams
Solids Content of Slurry	40 per cent

The essentials of the experimental procedure consisted of grinding a charge for 15, 30, 45, and 60 minutes. At the end of each time period, the entire charge was removed from the pebble mill and washed off the pebbles. The ground slurry was screened on a 200-mesh Tyler sieve and the minus 200-mesh portion was treated by sedimentation to remove the minus 10-micron particles. (Minus 10-micron sedimentation time was based on the rate of settling of 10-micron quartz particles.) The three sized products, plus 200 mesh, minus 200 mesh plus 10 microns, and minus 10 microns, were dried and weighed. The resulting data are plotted in

Figure 5. The three curves shown in the figure permit determination of the amount of any of the three size ranges present in the ground talc at any given time.

It is interesting to note that, after a 60-minute grind, only about 11 per cent of the talc was coarser than 200 mesh, 42 per cent was in the desired size range of minus 200 mesh plus 10 microns, and about 44 per cent was finer than 10 microns. One of the grinding objectives was to produce less than about 27 per cent of minus 10-micron particles and, since a 60-minute grind produced 44 per cent, the time of grinding was much too long. If some shorter time of grind is selected, say 15 minutes or 11 minutes, the desired results are almost obtained. Table 1 shows the weight distributions of the ground products at the end of 15 minutes and of 11 minutes.

TABLE 1. DISTRIBUTION OF SIZES AFTER 15- AND 11-MINUTE WET-GRINDING PERIODS OF ROM ITALIAN TALC

Sized Product	Distribution			
	Weight Per Cent of Total Product		Weight Per Cent After Removal of Plus 200-Mesh Fraction	
	15 Min	11 Min	15 Min	11 Min
+ 200 mesh	48	58	0.0	0.0
-200 mesh + 10 micron	36	30	69.2	71.5
-10 micron	16	12	30.8	28.5
Total	100	100	100.0	100.0

The data given in Table 1 show that 11 minutes should give about the same grind as that found in Italian No. 2 talc. That is to say, after removal of the plus 200 mesh (which in normal operation would be returned to the pebble mill for further grinding), the minus 200-mesh talc contained 28.5 per cent of minus 10-micron particles, compared with about 27 per cent in Italian No. 1. A still shorter time of grind appears necessary, and calculations for a 6-minute grind show that the minus 200-mesh talc would contain about 25 per cent of minus 10-micron particles.

As the time of grind is decreased, the amount of plus 200-mesh talc to be reground is increased and, in a continuous operation, would increase the circulating load. It is common commercial practice to use large circulating loads to minimize overgrinding.

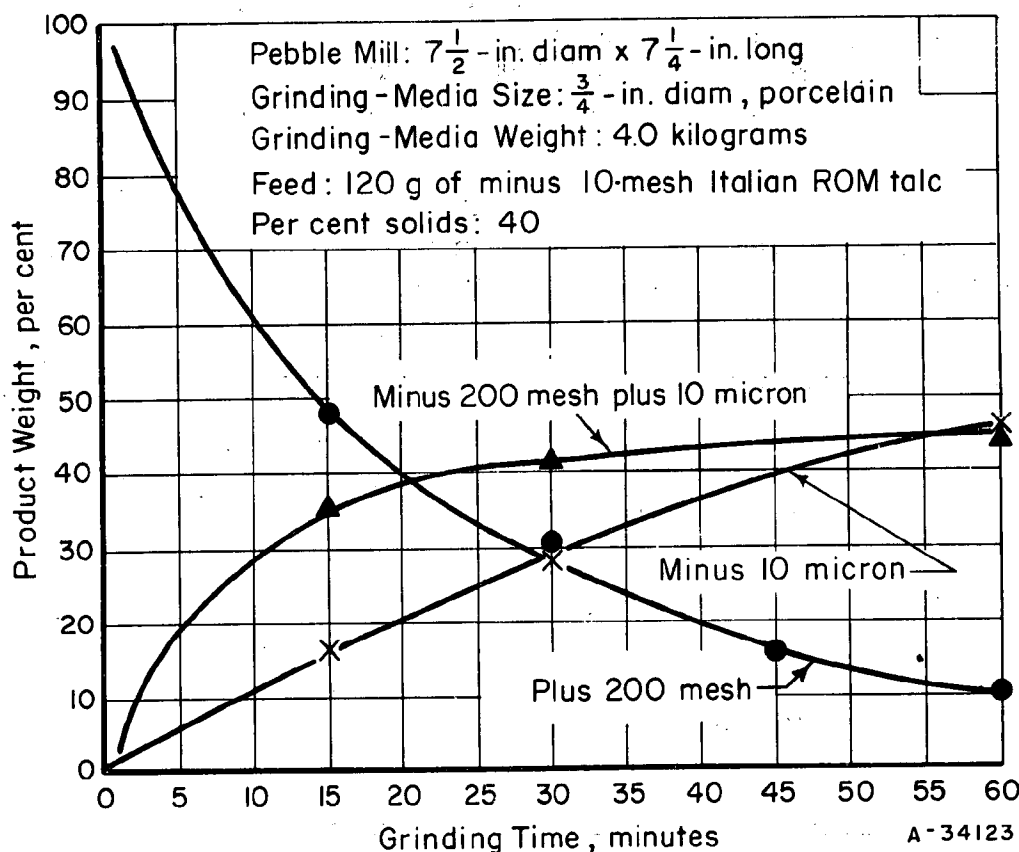


FIGURE 5. THE EFFECT OF GRINDING TIME ON THE PER CENT OF MINUS 200-MESH PLUS 10-MICRON AND MINUS 10-MICRON TALC PRODUCED

The data given in Table 1 and Figure 5 must be used as a guide only, but should be useful for making reasonable estimates for grinding performance and trends.

Grinding studies were carried a step further at a later date (after a number of flotation tests had been made) but are discussed here for conformity.

Simulated Closed-Circuit Grinding

Investigations were made on wet grinding that simulated continuous closed-circuit grinding, although actually consisting of batch grinds of short duration. A circulating load consisting of the unground plus 200 mesh was returned to the mill for further grinding, as is common in continuous-grinding practice.

The essential parts of the procedure were to add a given weight of charge to the pebble mill, grind for a specified time, and screen the ground product on a 200-mesh sieve. The plus 200-mesh portion was returned to the mill as a circulating load and a new amount of minus 10-mesh feed, equivalent in weight to the minus 200 mesh produced, was added to the pebble mill. This was repeated several times, until the mill charge came to equilibrium or, in other words, until the amount of minus 200 mesh produced from each grind was about the same weight as in the preceding grind. The foregoing procedure was followed for grinding periods of 15 minutes on a 120-gram talc charge and 11 minutes on a 240-gram charge. The ground products were separated at 200 mesh and 10 microns in the usual manner, by screening and sedimentation. The results obtained are given in Table 2.

Table 2 shows two separate sets of grinding conditions and the resulting distribution of sizes in the ground products. After a 120-gram charge was ground for 15 minutes, the resulting slurry contained 18 per cent of the weight in particles finer than 10 microns. Only 29.9 per cent of the talc was in the desired particle-size range of minus 200 mesh plus 10 microns. About 52 per cent of the ground product was returned to the pebble mill as a circulating load. After the plus 200-mesh portion was screened out, the minus 200-mesh slurry contained 37.5 per cent of the weight finer than 10 microns. This was considered as overgrinding, because one of the objectives was to grind in a manner that would result in less than 27 per cent of the weight finer than 10 microns.

In order to overcome the excessive overgrinding, an experiment was made that would increase the circulating load substantially. The amount of talc initially charged to the mill was increased to 240 grams and the grinding time was shortened to 11 minutes. The size distribution of the ground product for the 11-minute grinding period shows that 8.0 per cent of

TABLE 2. RESULTS OF A SIMULATED CLOSED-CIRCUIT
GRIND ON MINUS 10-MESH ROM ITALIAN TALC

Grinding Time, minutes	15	11
Mill, 7-1/2-in. diam x 7-1/4-in. long	Pebble	Pebble
Mill Speed, rpm	70	70
Weight of Pebbles, kilograms	4	4
Average Pebble Size, inches	3/4	3/4
Initial Talc Charged to Mill, grams	120	240
Minus 10-Mesh New Feed to Mill, grams	57.5	55
Plus 200 Mesh Returned to Mill, grams	62.5	185
Per Cent Solids in Mill	40	40
Circulating Load, per cent of new feed	108.7	336.3
Size Distribution of Pebble-		
Mill Discharge, per cent		
+ 200 Mesh	52.1	77.1
-200 Mesh + 10 Micron	29.9	14.9
-10 Micron	18.0	8.0
Total	100.0	100.0
Size Distribution of Pebble-		
Mill Discharge After Removal		
of Plus 200-Mesh Minerals, per cent		
-200 Mesh + 10 Micron	62.5	65.0
-10 Micron	37.5	35.0
Total	100.0	100.0

the weight was finer than 10 microns. At first glance, it might appear that the objective had been accomplished. However, after removal of the plus 200-mesh portion of the ground product, the minus 200-mesh material contained 35 per cent of the weight finer than 10 microns. So it is noted that, although the circulating load was increased from 108.7 per cent for the 15-minute grind to 336.3 per cent for the 11-minute grind, and with a doubled charge, the net result is a reduction of minus 10-micron talc from 37.5 per cent to 35 per cent. The reason for such a slight change in the amount of 10-micron material produced is not fully understood. In order to arrive at the objective of producing less than 27 per cent of minus 10-micron talc in the minus 200-mesh product, more variables would have to be investigated, such as shorter grinding time, larger or mixed diameter pebbles, coarser size talc as pebble-mill feed, and perhaps increased dilution.

It was felt that grinding characteristics on a continuous basis, with coarser ore feed, larger diameter pebbles, and continuous classification, would all favor reaching the size-distribution objective; therefore, the laboratory grinding program was terminated.

Another objective of pebble milling was to obtain a product with a noticeably higher luster than that exhibited by the Italian No. 2 talc, which had been dry ground in a Raymond-type roller mill. The first wet-grinding experiment in the pebble mill was successful in this respect. In fact, all wet-grinding experiments gave ground products having a relatively high luster.

The next step in the investigation involved the separation of the minus 10-micron talc from the minus 200-mesh ground product.

Hydraulic Classification of Pebble-Mill Product

Particle-size classification of the pebble-mill product for removal of minus 10-micron particles was necessary in order to prepare a satisfactory flotation feed and at the same time to remove potential dust-forming minerals.

The ground ore from the pebble mill was screened on a 200-mesh Tyler sieve for removal of objectionable oversize talc. The minus 200-mesh portion was adjusted with water to 5 per cent solids by weight and cycloned in a 30-mm-diameter glass cyclone.

A complete description of the cyclone process and of various experiments on the classification of Italian No. 2 talc has been reported* to Johnson and Johnson. In that report, a cycloning procedure was described

*Brown, W. E., "The Physical Concentration of Talc Ores - Flotation of Italian No. 2. Talc", Battelle Progress Report to Johnson and Johnson (July 31, 1959).

and was considered an acceptable method for removal of objectionable fine particles. There was no reason to believe that a change in classification procedure was necessary. If the classification of the ROM ground talc were satisfactory, using the same procedure, it would aid in establishing that the classification part of the beneficiation process was applicable to both the Italian No. 2 and ROM talcs.

The pebble-mill wet-ground products, as reported in Table 3, were screened on 200 mesh and the minus 200-mesh portions were hydraulically cycloned for elimination of as much of the minus 10-micron particles as was practicable in one stage of classification.

In discussing the removal of minus 10-micron particles, it is necessary to qualify the purpose and the results. A preponderance of minus 10-micron particles in a flotation feed creates a voluminous froth that not only is difficult to break down, but also traps the undesirable minerals. Removal of minus 10-micron particles is further desirable because of their dusting potential. However, it is not necessary to remove all of the minus 10-micron particles to obtain a satisfactory froth, nor is it necessary to remove all of such particles to eliminate excessive dusting. Perhaps total dusting tendency never can be eliminated, because particles larger than 10 microns will be airborne occasionally. A compromise was accepted when a product was obtained that would contain about 10 to 12 per cent of minus 10-micron particles. Finally, it would be economically impractical to achieve absolute 10-micron-particle rejection, and it may even be mechanically impossible.

Therefore, in discussions of this nature, "removal of minus 10-micron particles", the meaning is that the product is treated in a manner that results in something less than about 10 to 12 per cent of the weight finer than 10 microns.

The cyclone classification of the ground products was tried with a feed pressure of 14.7 psi applied to the 15-minute-ground product and 14.7 and 23.0 psi applied to the 11-minute-ground product. The results of classification of these experiments are given in Table 3.

Table 3 shows that, when a 15-minute pebble-milled product was cycloned at 14.7-psi inlet pressure, an excessive amount, 48.5 per cent, of the feed weight was rejected in the cyclone overflow. Sedimentation analysis showed that 42 per cent of the weight of the overflow product was of particles larger than 10 microns. Therefore, 32.6 per cent of all the plus 10-micron talc in the cyclone feed was lost or rejected in the cyclone overflow.

When the product of an 11-minute grind was cycloned at 14.7-psi inlet pressure, the amount of cyclone overflow dropped to 36.7 per cent and contained 31.9 per cent by weight of plus 10-micron material.

TABLE 3. DISTRIBUTION OF WEIGHT AND PARTICLE SIZE OF HYDRAULICALLY CLASSIFIED
(CYCLONED) MINUS 200-MESH PEBBLE-MILLED PRODUCTS

Operating Conditions:

Cyclone Diameter, mm	30
Feed Inlet Diameter, mm	6
Overflow Vortex Diameter, mm	11
Underflow Apex Diameter, mm	5.5
Feed Solids Content, per cent	5
Feed Volume Rate, gpm	
At 14.7 psi	2.7
At 23.0 psi	3.3

Grinding Time, min	Cyclone Product	Weight Per Cent	Weight Per Cent in		Distribution Per Cent in		Remarks
			-10 μ	+10 μ	-10 μ	+10 μ	
15	Feed	100.0	37.5	62.5	100.0	100.0	Feed pressure 14.7 psi
	Overflow	48.5	58.0	42.0	75.0	32.6	
	Underflow	51.5	18.2	81.8	25.0	67.4	
	Total	100.0	37.5	62.5	100.0	100.0	
11	Feed	100.0	35.0	65.0	100.0	100.0	Feed pressure 14.7 psi
	Overflow	36.7	68.1	31.9	71.4	18.0	
	Underflow	63.3	15.8	84.2	28.6	82.0	
	Total	100.0	35.0	65.0	100.0	100.0	
11	Feed	100.0	36.2	63.8	100.0	100.0	Feed pressure 23.0 psi
	Overflow	36.7	75.1	24.9	76.2	14.3	
	Underflow	63.3	13.6	86.4	23.8	85.7	
	Total	100.0	36.2	63.8	100.0	100.0	

Therefore, the amount of plus 10-micron particles lost to the overflow is reduced from 32.6 per cent in the 15-minute grind to 18 per cent in the 11-minute grind.

Further reduction in loss of plus 10-micron particles was achieved by increasing the cyclone feed pressure to 23 psi; at this pressure, 14.3 per cent by weight of the plus 10-micron particles was lost.

Although the foregoing discussion pertains to recovery or distribution of the plus 10-micron particles, it is equally important to know how effective was the rejection of the potential dust, or minus 10-micron particles. Table 3 shows that the highest rejection of minus 10-micron particles to the cyclone overflow was obtained from the cycloning of an 11-minute pebble-mill-ground product at 23-psi cyclone feed pressure. The cyclone overflow contained 76.2 per cent of all the minus 10-micron particles contained in the cyclone feed. Although 23.8 per cent of all the minus 10-micron particles were in the cyclone underflow, this was offset by the high recovery of the plus 10-micron particles. As a result, the cyclone underflow representing 63.3 per cent of the feed weight contained only 13.6 per cent of minus 10-micron particles.

The summary of this work is:

- (1) Classification for 10-micron-particle separation was more effective on the shorter grind, that is, 11 minutes.
- (2) Classification for 10-micron-particle separation was more efficient when the feed pressure was increased from 14.7 to 23.0 psi. This is true for both the best recovery of plus 10-micron particles and highest rejection of the minus 10-micron particles.

Although the data indicate that cyclone feed pressures in excess of 23 psi might result in still higher efficiencies of separation, it is probable that with higher pressures the weight per cent of the overflow product may increase.

Another point worthy of mention is that 14.3 per cent of the original plus 10-micron particles are lost to the cyclone overflow. If this cyclone overflow were to be treated in a second stage of cyclones, some of the plus 10-micron fraction would be recoverable. The amount recoverable, without including an undesirable amount of minus 10-micron-particle weight, probably would not exceed 85.7 per cent of 14.3 per cent, or 12.3 per cent. It certainly should not be less than 6 per cent. Assuming that 60 per cent of the flotation feed weight is recovered, the potential over-all increase is from about 4 to 7 per cent of the original weight of the talc.

Flotation

Microscope examination of the ROM head sample revealed that the ore was mineralogically the same as Italian No. 2 talc. Because of the similarity of the two samples, it was believed that the beneficiation procedures of classification at about 10 microns followed by flotation of the plus 10-micron product (cyclone underflow) would be effective when the same flotation conditions were applied.

Generally, the flotation conditions that had given good results with Italian No. 2 talc were pulp densities in the range of 5 to 10 per cent solids, and hydrochloric acid and Dowfroth 200 or 250 as reagents. Hydrochloric acid was used both to neutralize the slurry and as an aid in the depression of fine-size particles. Dowfroth 200 or 250 was selected as the talc frother-collector because it is totally water soluble, requires a minimum of conditioning time, and has no collecting properties for other than the natural-floating-type minerals. Some of the advantages of the Dowfroths are that they do not leave any residual odor or discoloration on dried mineral products, nor do they chemically attack metal or rubber to any significant degree.

Experiments were made on the talc wet-ground through 100 mesh and wet- and dry-ground through 200 mesh. The ground products were cycloned, and the cyclone underflow constituted the flotation feed.

Flotation of Wet-Ground Minus 100-Mesh ROM Talc

The first flotation experiment on ROM talc was made on a sample that had been wet ground through 100 mesh and cyclone classified for removal of fines.

The 100-mesh grind, as a possible maximum size limit, was made for the following reasons:

- (1) Coarse platelets probably would exhibit a higher luster than fine platelets.
- (2) A 100-mesh grind is substantially less expensive than a finer grind.
- (3) A 100-mesh grind produces less fines to be rejected than a finer grind, and consequently the over-all yield or recovery would be greater.
- (4) It was desirable to know whether the froth product from a 100-mesh grind would be gritty, even though platy in structure.

B A T T E L L E M E M O R I A L I N S T I T U T E

TABLE 4. FLOTATION RESULTS OBTAINED FROM ROM TALC WET-GROUND THROUGH 100 MESH

Product	Weight Per Cent	Mineral Count, per cent				Reagents Added, lb/ton. of flotation feed		Feed, per cent solids
		Platy	Nonplaty	Dolomite	Tremolite	HCl	Dowfroth 200	
<u>Test 88</u>								
Float-1	66.1	96	3	<1	<1	1.42	0.05	9.3
Float-2	22.9	95	4	<1	<1	0	0.21	--
Underflow	11.0	55	26	16	3	--	--	--
Total	100.0	91	6	2-3	1-2	1.42	0.26	--
<u>Test 89</u>								
Float-1	60.2	97	2	<1	<1	0.0	0.05	10.0
Float-2	20.5	Not evaluated				0.0	0.21	--
Underflow	19.3	Not evaluated				--	--	--
Total	100.0					0.0	0.26	--

Note: Flotation feed was cyclone underflow, which represented 83.0 per cent of the weight of the original ground sample.

Tests 88 and 89 were duplicates, except that hydrochloric acid was used in Test 88 and no acid was used in Test 89. Table 4 shows the experimental conditions and the results.

The results given in Table 4 are not particularly encouraging, because neither experiment yielded a Float-1 product containing more than 97 per cent platy talc. The Float-1 product of Test 88 contained 96 per cent platy talc and Float-1 of Test 89 contained 97 per cent platy talc. The difference between 96 and 97 per cent is not considered significant, and the two tests can be considered to yield the same quality of Float-1 product. However, there was a marked difference in the amount of weight recovered in the Float-1 products. In Test 88, 1.42 pounds of HCl per ton were used, and the Float-1 product represented 66.1 per cent of the flotation feed weight. When no acid was used, as in Test 89, the weight per cent of Float-1 was 60.2 per cent. Prior experience with Italian No. 2 talc implied that the reverse condition would result. That is, higher recoveries usually result when no acid is used, although the platy content might decrease slightly. It would not be safe to call these tests conclusive as long as this anomaly is not confirmed.

Both Float-1 products had a high luster but felt gritty.

The Float-1 product of Test 88 was screened on 150- and 200-mesh Tyler sieves, and the separated fractions were examined by microscope. The results are given in Table 5.

TABLE 5. PROPERTIES OF FLOAT-1 PRODUCT FROM MINUS
100-MESH WET-GROUND TALC

Size, Tyler Mesh	Weight Per Cent	Platy Talc, per cent	Remarks
-100+150	10.1	99	High luster, gritty
-150+200	23.1	98-99	High luster, gritty
-200	66.8	95	High luster, good slip
Total	100.0	96	High luster, gritty

Table 5 shows that the plus 200-mesh particles were 98 to 99 per cent platy talc, whereas the minus 200-mesh particles were only 95 per cent platy talc. Although the plus 200-mesh talc was of high purity, the thickness of the platelets produced a gritty texture. The minus 200-mesh portion, though only 95 per cent platy talc, had both a high luster and a good slip.

It is probable that the platy content of the Float-1 products from a 100-mesh grind could be improved, but, because of the objectionable gritty nature of the powder, it was decided to investigate the results obtainable from the conventional 200-mesh grind.

Flotation of Dry-Ground Minus 200-Mesh ROM Talc

Experiments were made on ROM talc that had been wet-ground and dry-ground through 200 mesh in a pebble mill. The ground products were cycloned for removal of the extreme fines, and the cyclone-underflow products were floated in the usual manner.

Three experiments were made on dry-ground talc and the results are given in Table 6.

The results given in Table 6 show that 97 per cent platy talc was obtained in the Float-1 product of each test. Tests 131 and 132 were made in an identical manner and, although the Float-1 products both contained 97 per cent platy talc, there was a noticeable difference in the weights recovered. Test 131, Float-1, contained 68.7 per cent of the flotation feed weight, but Test 132, Float-1, contained only 63.5 per cent of the flotation feed weight. There is no obvious explanation for this difference in weight recoveries. It is noticed, however, that the weight recovered in the Float-1 combined with the Float-2 is about the same, 91 to 92 per cent, in each of the three tests.

When the Float-1 products were examined under the microscope, it was found that some of the platelet surfaces were pitted. The amount of pitted platelets reporting to the Float-1 product was about 2 per cent, or 95 per cent normal platelets plus 2 per cent pitted platelets. This pitting or pockmarking was not noticed again either in the Italian No. 2 talc or in the subsequent ROM wet-pebble-milled flotation products, and apparently is a characteristic of dry-pebble milling.

Flotation of Wet-Ground Minus 200-Mesh ROM Talc

Flotation tests were made on wet-ground products, after cycloning for rejection of fines, to investigate the effect of acid strength and frother types on the Float-1 products.

Effect of HCL on Recovery and Quality. The effect of HCL on the flotation of Italian No. 2 talc was discussed briefly in the First Progress Report and in some detail in the Second Progress Report on "The Physical Concentration of Talc Ores". In the Second Progress Report, of July 31, 1959, it was stated in the "Summary" that, "Hydrochloric acid added in the

TABLE 6. RESULTS OBTAINED FROM FLOTATION OF DRY-GROUND, WET-CYCLONED ITALIAN ROM TALC

Product	Weight(a) Per Cent	Mineral Count, per cent			Reagents Added, lb/ton of flotation feed				Pulp,		
		Platy	Nonplaty	Dolomite	Tremolite	HCl	Dowfroth 200	Dowfroth 250	pH	Per Cent Solids	
<u>Test 103(b)</u>											
Float-1	63.3	97	<2	<1	1	0.00	0.07	0.00	8.6(c)	4.8	
Float-2	27.7	Not evaluated				0.00	0.28	0.00			
Underflow	9.0	Not evaluated				--	--	--			
Total	100.0					0.00	0.35	0.00			
<u>Test 131(d)</u>											
Float-1	68.7	97	1	0.8	1	1.54	0.00	0.06	6.9(e)	9.7	
Float-2	23.3	Not evaluated				0.00	0.00	0.23	6.9		
Underflow	8.0	Not evaluated				--	--	--			
Total	100.0					1.54	0.00	0.29			
<u>Test 132(d)</u>											
Float-1	63.5	97	1	0.7	1	1.57	0.00	0.06	7.0(e)	8.9	
Float-2	28.2	Not evaluated				0.00	0.00	0.25	7.0		
Underflow	8.3	Not evaluated				--	--	--			
Total	100.0					1.57	0.00	0.31			

(a) Weight per cent refers to per cent of flotation feed.

(b) Flotation feed was treated in a 8.50-liter-capacity (nominal) Deco flotation cell. Tests 131 and 132 were made in a 1.75-liter-capacity (nominal) Fagergren flotation feed.

(c) Distilled water was used to form the talc slurry.

(d) Tests 131 and 132 were intended to be duplicate tests.

(e) Deionized water was used to form the talc slurry.

correct quantity, between 1.13 and 2.30 pounds per ton of feed solids, was effective in maintaining the purity of finished talc at 97 to 98 per cent platy particles. This amount of acid created a pulp pH ranging between 6.9 and 7.8 during flotation." It was stated elsewhere in the report that the addition of HCl in amounts up to 2.30 pounds per ton of feed solids would appear to be justified only if it were effective in inhibiting the inclusion of fine talc and aiding in froth control.

Tests 121, 122, 123, and 124 were made to compare the results obtained when acid was used and when it was omitted. Dowfroth 200 was used as the collector-frother in each test. The results given in Table 7 show that, when HCl was used in the amount of 2.05 to 2.34 pounds per ton of flotation feed, the Float-1 product was 99 per cent platy talc. The amount of weight recovered in Float-1 was higher when acid was used than when it was omitted, although the weight recovered decreased when the strength of the acid was increased from 2.05 to 2.34 pounds per ton.

The data given in Table 7 are not fully consistent. In Tests 122 and 124, when no acid was used, the Float-1 products were 97 and 99 per cent platy talc, respectively, and a weight recovery of about 55 per cent of the flotation feed was obtained in each product. If the difference in quality is important, more experiments would be necessary to establish the cause of the difference in platy talc content.

In Test 121, 63.8 per cent of the flotation feed weight was recovered in Float-1 and the product was 99 per cent platy talc. The pH during flotation varied between 6.4 and 6.6. A size distribution, by sedimentation, showed that 19.7 per cent of the Float-1 product was finer than 10 microns. This could mean that the flotation feed had been incompletely classified (the original ore being overground) and that the amount of HCl added had not been highly effective for additional rejection of fine particles during flotation.

Effect of Type of Frother on Recovery and Quality. Two different frothers were investigated to determine the effect on the recovery and quality of the Float-1 products. These frothers were Dowfroth 200 and Dowfroth 250. Both of these frothers are 100 per cent water soluble, although Dowfroth 250 is classed as the stronger of the two. The manufacturer, Dow Chemical Company, Midland, Michigan, claims that less Dowfroth 250 is needed to accomplish the same effect as a larger amount of Dowfroth 200.

The results of experiments that illustrate the influence of the type of frother on flotation results are given in Table 8.

Data given in Table 8 show that, under certain operating conditions, Dowfroth 250 was a stronger frother-collector than Dowfroth 200.

TABLE 7. EFFECT OF HCl ON FLOTATION RESULTS

Product	Weight(a) Per Cent	Mineral Count, per cent			Reagents Added, lb/ton of flotation			Pulp	
		Platy	Nonplaty	Dolomite Tremolite	HCl	Dowfroth 200 feed	pH	Per Cent Solids	
<u>Test 121</u>									
Float-1(b)	63.8	99	<1	<1	2.05	0.08	6.4	6.9	
Float-2	19.1	95			0.00	0.31	6.6		
Underflow	17.1				--	--			
Total	100.0				2.05	0.39			
<u>Test 122</u>									
Float-1	55.6	97	1	<1	0.00	0.08	7.8	6.2	
Float-2	27.5				0.00	0.34	6.9		
Underflow	16.9				--	--			
Total	100.0				0.00	0.42			
<u>Test 123</u>									
Float-1(b)	57.5	99	<1	0.4	2.34	0.09	6.7	6.1	
Float-2	24.3				0.00	0.35	6.9		
Underflow	18.2				--	--			
Total	100.0				2.34	0.44			
<u>Test 124</u>									
Float-1	55.5	99	<1	0.5	0.00	0.09	8.1	5.9	
Float-2	25.4				0.00	0.37	7.0		
Underflow	19.1				--	--			
Total	100.0				0.00	0.46			

(a) Weight per cent refers to per cent of flotation feed.

(b) The Float-1 products of Tests 121 and 123 were given to W. H. Ashton, of Johnson and Johnson, and were considered representative of what may be expected from a pilot-plant operation. These products, although containing an excess amount of minus 10-micron particles, were of interest principally because of their high luster.

TABLE 8. EFFECT OF TYPE OF FROTHER ON FLOTATION RESULTS

Product	Weight(a) Per Cent	Mineral Count, per cent			Reagents Added, lb/ton of flotation feed			Pulp	
		Platy	Nonplaty	Tremolite	HCl	Dow 200	Dow 250	pH	Per Cent Solids
Test 121 Float-1	63.8	99	<1	<1	2.05	0.08	0.00	6.4	6.9
Test 125 Float-1	64.1	98	<1	0.3	2.06	0.00	0.08	6.5	6.9
Test 122 Float-1	55.6	97	1	1	0.00	0.08	0.00	7.8	6.2
Test 126 Float-1	66.0	96	1	0.3	0.00	0.00	0.08	7.7	6.8
Test 157 Float-1	51.8	97	2	0.3	2.45	0.11	0.00	5.8	5.3
Test 158 Float-1	56.3	97	2	0.3	2.40	0.00	0.11	5.6	5.4
Tests 147-148 Float-1	62.1	97	2	<1	1.66	0.00	0.06	6.4	7.9
Test 142 Float-1	55.9	96	<3	0.2	2.72	0.00	0.09	5.4	6.3

(a) Weight per cent refers to per cent of flotation feed.

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A comparison of Tests 121 and 125 shows that, when about 4 pounds of HCl and 0.08 pound of either frother per ton of flotation feed was used (creating a pH of 6.4 to 6.5), the amount of weight recovered in the Float-1 product was approximately 64 per cent. The quality of the floated products was essentially the same at 98 to 99 per cent platy talc particles.

These experiments were repeated without acid, but the amount of frother added was kept at 0.08 pound per ton of flotation feed, and are reported as Tests 122 and 126. When Dowfroth 200 was used, the weight recovered from the flotation feed was 55.6 per cent, compared with 66.0 per cent when the stronger Dowfroth 250 was used. The platy content of the float product, however, was only 96 per cent when Dowfroth 250 was used, compared with 97 per cent when Dowfroth 200 was used.

The weight recovery of 55.6 per cent in the Float-1 product of Test 122 appears too low and probably should not be considered as a firm figure without repeating the experiment.

Tests 142, 157, and 158 were made with increased amounts of acid and frother. The amount of frother was increased to obtain higher recovery and the amount of acid was increased to retard the flotation of undesirable minerals. The results show that, when the acid strength was in excess of 2.40 pounds per ton of feed, it had a definite tendency to decrease the weight recovered, even though the amount of frother-collector was increased from 0.08 to 0.11 pound per ton of flotation feed. In addition to this, the increased acid strength was not effective in improving the platy content beyond 97 per cent.

The conclusions from the experiments reported in Table 8 are:

- (1) Maximum grade and recovery are effected adversely if the flotation-pulp pH is less than 6.4, regardless of which frother is used.
- (2) Dowfroth 250 is a stronger frother-collector for platy talc than Dowfroth 200.
- (3) Better quality float products can be obtained with acid than without, providing the pH does not become less than 6.4.

All Float-1 products from ROM talc had a high luster; that is, the luster from these products was definitely of a higher order than was obtained from any float products from Italian No. 2 talc.

The deionized water used in all flotation experiments from Test 121 through Test 158 had a resistance of 105,000 to 150,000 ohms per cubic centimeter.

The amount of time available did not permit an extensive evaluation of the physical properties of the flotation products, and for the most part the products were rated solely by a microscope mineral count and subjective measurements of luster and feel or slip. The flotation products obtained compared favorably with the Italian No. 2 flotation products with respect to platy talc and dolomite content, and therefore it was believed that the properties of lubricity and alkalinity (pH of moistened, beneficiated products) would be essentially the same for both the ROM and the Italian No. 2 talcs. Bulk density was spot-checked on various Float-1 products and found to be in the range of 23 to 25 pounds per cubic foot.

The amount of minus 10-micron particles contained in the Float-1 products was also spot-checked and found to be between 9 and 20 per cent. The appearance of any excess amount of minus 10-micron particles in the Float-1 products is attributed to overgrinding and incomplete cyclone classification, rather than to flotation. In fact, there is evidence that flotation is helpful in the rejection of minus 10-micron particles.

The weight recovery expected from a continuous operation can be estimated reasonably closely by using data available from Test 121 (see Table 7). In this test, the Float-1 product was 63.8 per cent of the flotation feed weight and the Float-2 product contained 19.1 per cent of the flotation feed weight. By returning the Float-2 product back to the new feed, it would be reasonable to expect that another 63.8 per cent of it would be recovered. Therefore, an estimated weight recovery from the flotation feed would show $63.8 + \frac{63.8 \times 19.1}{100} = 76$ per cent. These calculations do not include a potential additional recovery that may be expected from scavenging the flotation underflow. It would not be unreasonable to expect an additional 3 to 5 per cent recovery by the scavenging step, followed by returning the scavenger froth back to the new feed. On this basis the total projected recovery in a continuous operation would be 80 per cent of the weight of the flotation feed.

The over-all recovery of high-grade talc from the original ore is also related to the efficiency of the pebble milling and hydraulic cycloning. Ore preparation as followed in Test 121 shows that 48.5 per cent of the original weight was rejected in the cyclone overflow as approximately minus 10-micron particles. This amount, 48.5 per cent, is far too much weight loss and should not be considered realistic, because the talc was overground. Ore preparation as followed in Test 151 (see Appendix) showed that only 31.7 per cent of the weight was rejected as cyclone overflow. This amount is also believed to be greater than would be obtained

from a continuous pilot mill or commercial circuit; 30 per cent is a realistic amount for estimating purposes. Therefore, the over-all estimated weight recovery would be $\frac{70 \times 80}{100} = 56$ per cent of the weight of the original ore.

Not all of the flotation experiments on Italian ROM talc are discussed in the text of this report. A complete tabulation of the experiments, showing the pertinent data, is presented in the Appendix.

PROPOSED PILOT-PLANT FLOWSHEET

Figures 6 and 7 show the proposed flowsheets based on laboratory experiments for crushing, grinding, and beneficiation of Italian ROM talc.

The crushing circuit is to be operated intermittently, to replenish the storage bin, but the grinding circuit is a continuous operation, so that the beneficiation process will have uninterrupted feed. The objective of the flowsheet design shown in Figure 6 is to provide a flexible system for treating a variety of ROM talc ores (not specifically Italian). This circuit is expected to handle talc that may be received in pieces as large as 8- or 10-inch slabs, hammermill in one pass through 1/4 inch, wet grind, and classify at approximately 200 mesh. The minus 200-mesh pulp is expected to leave the circuit at 4 to 7 per cent solids, which is an ideal feed to the beneficiation circuit. It is expected that the amount of minus 10-micron talc produced can be held to a reasonable maximum by controlling the circulating load in the grinding circuit, grinding pulp density, pebble diameter, and total weight of charge, and, finally, by dilution of cyclone feed.

The flowsheet shown in Figure 7 is essentially the same as that developed for processing the Italian No. 2 talc*. Laboratory experiments showed that the same general results would be obtained from either ROM or Italian No. 2 talc. If the grinding circuit could be operated efficiently, a higher yield of beneficiated talc could be expected from the ROM talc than from the Italian No. 2 talc.

*Brown, W. E., "The Physical Concentration of Talc Ores - Flotation of Italian No. 2 Talc", Battelle Progress Report to Johnson and Johnson (July 31, 1959).

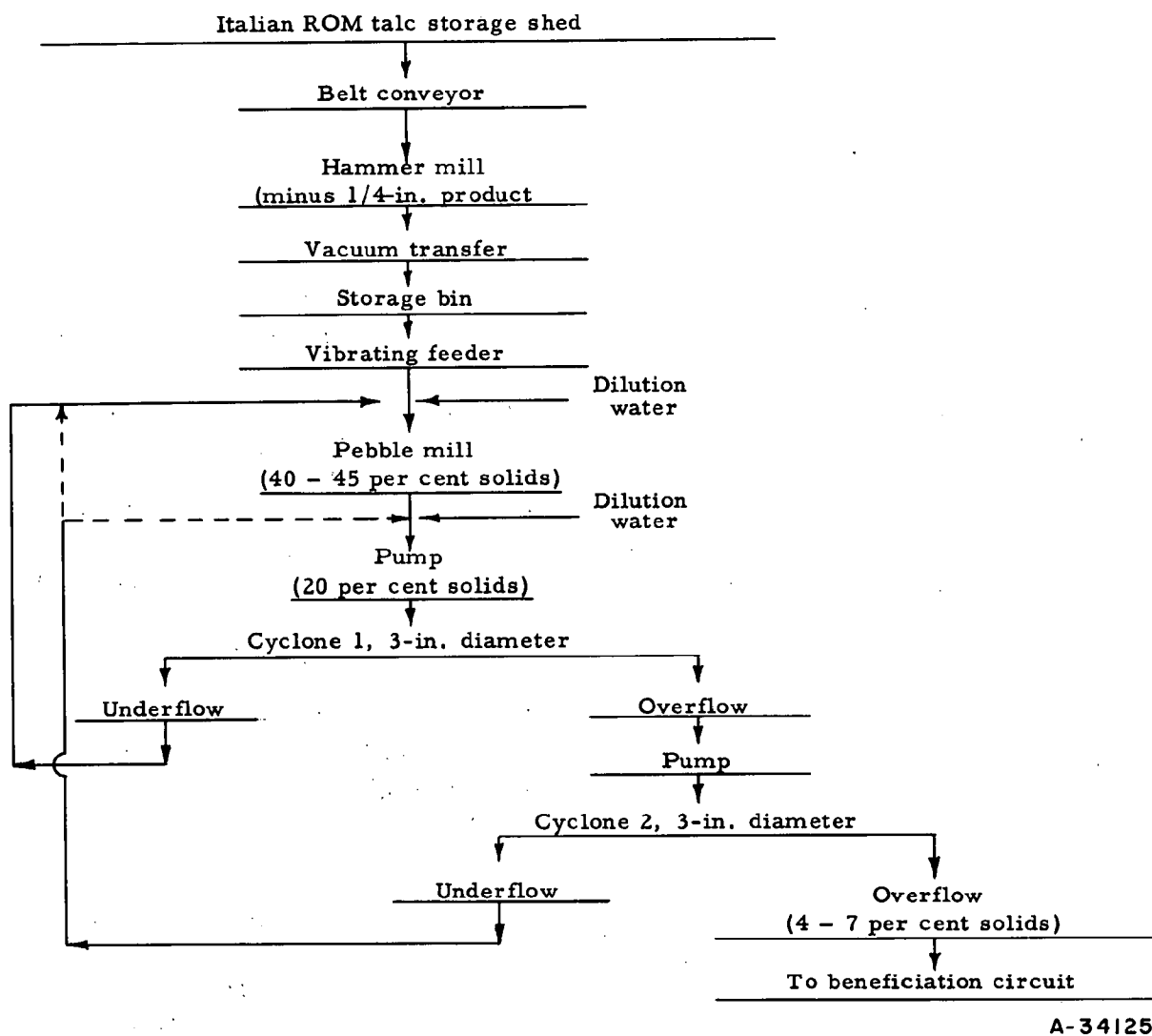


FIGURE 6. PROPOSED PILOT-PLANT FLOWSHEET - CRUSHING AND GRINDING CIRCUIT



JNJAZ55_000000834

CONCLUSIONS

Data and observations obtained from the grinding, cycloning, and flotation experiments have established that:

- (1) Italian ROM talc can be beneficiated by the combined processes of crushing, grinding, classifying, and flotation. The finished beneficiated talc will have a high luster and will be 97 to 99 per cent platy talc. The yield expected in a continuous operation is 80 per cent of the flotation feed, or 56 per cent of the original ore.
- (2) Wet-pebble-mill grinding is more effective in obtaining 200-mesh grinds than dry-pebble-mill grinding, although less minus 10-micron talc is produced from dry grinding.
- (3) Wet-pebble-mill grinding yields a product that, after cycloning and floating, shows a marked improvement in luster compared with the products obtained from the beneficiation of Italian No. 2 talc.
- (4) ROM talc must be ground finer than 100 mesh, or the resulting flotation products will have a gritty texture.
- (5) The highest quality products were obtained when the flotation feed pulp was maintained at a pH of 6.4 or higher.
- (6) Water-soluble frothers, such as Dowfroth 200 or Dowfroth 250, are good promoters for the flotation of platy talc. There are indications that Dowfroth 250 is the stronger promoter of the two, but it may be slightly less selective.
- (7) The experimental results show that the processes of classification, flotation, and filtering as developed for Italian No. 2 talc can be adapted to Italian ROM talc. No change in equipment types or sizes should be necessary.

Table 9 shows the Johnson and Johnson specifications for Italian No. 1 talc and includes a comparison of these specifications with the beneficiated products from the Italian No. 2 and ROM talcs.

This table shows that the beneficiated products contain less than 0.75 per cent of dolomite and less than 1 to 3 per cent of nonplaty minerals. The bulk density of the beneficiated product was within the specification of 22 to 27 pounds per cubic foot.

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TABLE 9. COMPARISON OF SPECIFICATIONS WITH THE BENEFICIATED PRODUCTS FROM ITALIAN NO. 2 AND ROM TALCS

Physical-Property Control	Specification	Italian No. 1, Johnson and Johnson Raw Material	Italian No. 2, Laboratory Beneficiated	Italian ROM, Laboratory Beneficiated
Moisture(a), per cent	<0.15	0.05	<0.05	<0.05
Solubility in HCl, per cent	<6	2.1-2.8	<0.75(b)	0.3-0.6(b)
Fineness, per cent through 200 mesh	Not less than 98.5	99.8	99.5	98.5
Bulk density, lb/ft ³	Not less than 22 nor more than 27	23.0	28-29	23-25
Microscopic structure, per cent platy	Platelet showing no acicular or excessive granular crystals	88-90	97-99	97-99
pH (Alkalinity)	7.0-7.5	9.0-9.3	8.1-8.8	8.3-8.6

(a) Moisture content would be significant only from a continuous plant operation, because laboratory products can be dried to any desired moisture content.

(b) Solubility in HCl as reported here is expressed as dolomite content, which was determined from CO₂ assay.

FUTURE WORK

Since the completion of the experimental work included in this report, a new reagent combination, involving Aerosol, has been developed. The development has led to improved results and will be presented in a separate report.

An experimental program is now in progress to establish how much of the water used in beneficiation can be re-used without adverse results to the over-all process.

The original notes on the laboratory work described in this report are in Battelle Laboratory Record Books 14668, 15042, 15190, 15456, and 15662. The work was done in the period from July 24, 1958, to April 20, 1959.

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APPENDIX

SUMMARIZED RESULTS OF ALL FLOTATION TESTS MADE ON
ITALIAN ROM TALC

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A-1 and A-2

Preparation						Flotation										Reagents Added, lb/ton of flotation feed				Remarks		
Test	Grind	Time Interval, Minutes	Feed, psi	Overflow, weight per cent	Underflow, weight per cent	Product	Weight Per Cent of Flotation Feed		Mineral Count, per cent				Pulping Water	PH of Float	Per Cent Solids of Float	Dowfroth						
							Floatation Feed	Original Feed	Play	Nonplay	Dolomite	Tremolite				HC(a)	200	250				
88	430	15	14.7	17.0	83.0	Float-1 Float-2 Underflow	66.1 22.9 11.0	54.9 19.0 9.1	96 95 55	3 4 26	<1 <1 16	<1 <1 3	Distilled Distilled Distilled	N.D.(b)	5.3	1.42	0.05	0	0.21	Wet-ground through 100 mesh		
89	430	15	14.7	17.0	83.0	Float-1 Float-2 Underflow	60.2 20.5 11.0	50.0 17.0 46.4	97 97 55	3 3 26	<1 <1 16	<1 <1 3	Distilled Distilled Distilled	N.D.(b)	10.0	0	0.05	0	0.05	Wet-ground through 100 mesh		
90	510	60	14.7	26.9	73.1	Float-1 Float-2 Float-3 Cleaner Float Cleaner U' Flow Underflow	63.5 16.1 14.7 48.8 32.0 8.4	46.4 11.8 10.7 35.7 23.4 6.1	95 97 95 99 96	<1 3 4 <1 3 3	Trace Trace <1 <1 <1 <1	Trace Trace Distilled Distilled Distilled Distilled		8.3	0	0.07	0	0.26	0	0.07	Wet-ground through 200 mesh	
91	510	60	14.7	26.9	73.1	Float-1 Float-2 Cleaner U' Flow Underflow	48.8 32.0 10.8 8.4	35.7 23.4 7.9 6.1	99 96	<1 3	<1 <1	<1 <1	Distilled Distilled		8.0	0	0.07	0	0.65	0	0.92	
92						Discarded because of contamination. Products used for filtration experiments.																
93	510	60	14.7	29.7	70.3	Float-1 Float-2	67.3 22.7	47.3 16.0	98 97	1 <2	0.4 <1	<1 1	Distilled Distilled	8.9 8.6	4.5 4.8	0	0.13	0	0.39	0	0.07	Produced for Johnson and Johnson examination Dry-ground through 200 mesh
103	500	60	14.7	Not determined		Float-1 Float-2	63.3 27.7		97 99	<2 <1	<1 <1	1 <1	Distilled Distilled			0	0.28					
104	120	15	14.7	48.5	51.5	Discarded. Results erratic because of overgrinding.																Float-1, 19.7 per cent was minus 10 microns Float-2, 13.1 per cent was minus 10 microns
121						Float-1 Float-2	63.8 19.1	32.9 9.8	99 95	<1 <1	<1 <1	<1 <1	Deionized Deionized	5.4 5.6	6.9	2.05	0.08	0	0.31			
122	120	15	14.7	48.5	51.5	Float-1 Float-2	55.6 21.5	28.6 14.2	97 99	1 <1	1 <1	1 <1	Deionized Deionized	7.8 6.9	6.2	0	0.88	0	0.34			
123	120	15	14.7	50.7	49.3	Float-1 Float-2	57.5 24.3	28.3 12.0	99 99	<1 <1	0.4 <1	<1 <1	Deionized Deionized	6.7 6.9	6.1	2.34	0.09	0	0.35			
124	120	15	14.7	50.7	49.3	Float-1 Float-2	55.5 25.4	27.4 12.5	99 98	<1 <1	0.5 0.3	<1 <1	Deionized Deionized	8.1 6.5	5.9	0	0.09	0	0.37			
125	120	15	23.0	46.8	53.2	Float-1 Float-2	64.1 23.4	34.1 12.4	98 96	<1 <1	0.3 0.3	1 2	Deionized Deionized	7.0 6.5	6.9	2.06	0.08	0	0.32			First test with Dowfroth 250
126	120	15	23.0	46.8	53.2	Float-1 Float-2	66.0 21.1	35.1 11.2	96 97	1 2	0.3 0.3	2 <1	Deionized Deionized	7.7 6.9	6.8	0	0.08	0	0.33			
129	240	11	23.0	34.7	65.3	Float-1 Float-2	65.6 21.2	42.8 13.8	97 97	2 2	0.3 0.3	<1 <1	Deionized Deionized	6.1 5.9	7.5	1.90	0.08	0	0.30			First test with fresh Dowfroth 250
130	240	11	23.0	34.7	65.3	Float-1 Float-2	64.0 24.0	41.8 15.7	97 97	2 1	0.3 0.8	<1 1	Deionized Deionized	5.9 6.9	7.3	1.94	0.08	0	0.31			
131	120	15	23.0	25.2	74.8	Float-1 Float-2	68.7 23.3	51.4 17.4	97 97	1 1	0.8 0.7	1 <1	Deionized Deionized	6.9 7.0	9.7	1.54	0.06	0	0.23			Dry-ground through 200 mesh
132	120	15	23.0	25.2	74.8	Float-1 Float-2	63.5 28.7	47.5 21.1	97 97	1 <3	0.7 0.2	<1 <1	Deionized Deionized	7.0 5.7	8.9	1.57	0.06	0	0.25			Dry-ground through 200 mesh
141	240	11	14.7	36.7	63.3	Float-1 Float-2	56.5 27.7	35.8 17.5	97 96	<3 <3	0.2 0.2	<1 <1	Deionized Deionized	6.4 5.4	6.7	2.59	0.08	0	0.34			
142	240	11	14.7	36.7	63.3	Float-1 Float-2	55.9 26.9	35.4 17.0	96 97	<3 2	0.2 <1	<1 <1	Deionized Deionized	6.2 6.4	6.3	2.72	0.09	0	0.36			
147, 148	240	11	23.0	35.7	64.3	Float-1 Float-2	62.1 23.3	39.9 15.0	97 96	2 2	<1 <1	<1 1	Deionized Deionized	6.3 5.9	7.9	1.66	0.06	0	0.41			
151	240	11	23.0	31.7	68.3	Float-1 Float-2	54.8 32.9	37.4 22.5	95 97	2 2	<1 <1	<1 <1	Deionized Deionized	6.1 6.9	6.3	2.05	0.05	0	0.41			
152	240	11	23.0	31.7	68.3	Float-1 Float-2	47.8 36.8	32.6 30.9	97 97	2 2	<1 0.3	<1 <1	Deionized Deionized	6.9 5.8	5.3	2.45	0.11	0	0.41			
157	240	11	23.0	40.7	59.3	Float-1 Float-2	51.8 25.5	33.7 15.1	97 97	2 2	0.3 0.3	<1 <1	Deionized Deionized	6.4 5.6	5.4	2.40	0.46	0	0.45			
158	240	11	23.0	40.7	59.3	Float-1 Float-2	56.3 27.8	33.4 16.5	97 97	2 2	0.3 0.3	<1 <1	Deionized Deionized	5.6 6.2	5.4	2.40	0.42	0	0.46			4/20/59

(a) HC3 is reported in terms of 35.5 to 38 per cent HCl having a specific gravity of 1.185 to 1.192 at 60 F.

(b) R.D. = not determined.

Note: Not all Float-2 products were examined for mineral distribution. Ordinarily, in a continuous operation, these products would show about 93 to 95 per cent play talc and would be returned to the flotation circuit for further cleaning.

Exhibit 43

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5 0 5 K I N G A V E N U E C O L U M B U S I . O H I O

January 24, 1958

Dr. W. H. Lycan
Director of Research
Johnson and Johnson
New Brunswick, New Jersey

Dear Dr. Lycan:

This letter report summarizes the results obtained to date on the beneficiation of talc by flotation which is a part of Phase 3 of our talc research program.

The primary objective of the flotation experiments was to obtain a product which was predominantly platy talc and which would contain a minimum of tremolite and carbonates. Only secondary attention was given to talc recovery.

Samples from three talc-bearing deposits were investigated. The mineralogical composition of these samples is given in Table 1. The composition of Italian Talc No. 1 is included for comparison.

TABLE 1. MINERALOGICAL COMPOSITION OF SAMPLES
INVESTIGATED

Sample	Mineral Count, per cent			
	Platy	Nonplaty	Carbonates	Tremolite
Oasis Mine (Nevada)	48	43	3	4
Stone Creek Mine (Montana)	30	67	1	2
Italian No. 2	90	6	3	1
Italian No. 1	88-90	8-10	<2	Trace

The three samples shown in Table 1 represent talc types containing low, intermediate, and relatively high percentages of platy talc. The Oasis and Stone Creek mine samples were tested for academic purposes and do not necessarily represent recommended ores. The sample identified as Italian No. 2 may be of more immediate interest to Johnson and Johnson.

Ten flotation tests were made and the results are summarized in Table 2.

TABLE 2. SUMMARIZED RESULTS OF TALC FLOTATION TESTS

Sample	Test No.	Product	Weight Per Cent	Approximate Mineral Count, Per Cent				Reagents Used
				Platy	Nonplaty	Carbonate	Tremolite	
Oasis		Head Sample	100.0	48	43	5	4	—
Oasis	1	Floot 1	32.2	77	20	1	3	None
Oasis	2	Floot 1	32.4	75	23	1	1	None
Oasis	3	Cleaner Floot	31.6	80	18	1	1	Dowfroth 200 <i>4.25% floot</i>
Oasis	5a	Floot 1	34.6	83	16	1	1	Dextrine
Oasis	8	Floot 1	26.9	82	15	1	2	Dextrine
Oasis	9	Floot 1	34.6	77	17	4	2	None
Stone Creek		Head Sample	100.0	30	67	1	2	—
Stone Creek	4	Floot 1	29.9	85	12	1	2	None
Stone Creek	6	Floot 1	25.0	86	10	2	2	Dextrine, Mg_2SiO_3
Italian No. 2		Head Sample	100.0	90	5	3	2	—
Italian No. 2	7	Floot	76.9	96	3	1	1	Dextrine, Dowfroth 200
Italian No. 2	10	Floot	75.3	96	3	1	1	Dextrine, Dowfroth 200
Italian No. 1*		Head Sample	100.0	88-90	8-10	1	Trace	

* Italian No. 1 talc is included in this table for comparison with the flotation products.

Battelle Memorial Institute

Dr. W. M. Lycan

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January 24, 1958

The data given in Table 2 show that it is relatively easy to obtain, from any of the samples tested, a flotation product enriched in platy talc. The Oasis head sample contained 48 per cent platy talc. The flotation product, Float 1, contained 83 per cent platy talc and represented 34.6 per cent of the flotation feed weight. The Stone Creek head sample contained 30 per cent platy talc. The flotation product, Float 1, contained 85 per cent platy talc and represented 29.9 per cent of the flotation feed weight.

Two flotation tests were made on Italian talc No. 2. The sample as received at Battelle is 90 per cent platy talc and 6 per cent non-platy talc. Flotation yielded a product containing 96 per cent platy talc and only 3 per cent of nonplaty talc. However, only 76.9 per cent of the original weight of the feed was recovered.

It is unlikely that the optimum results for purity of product and recovery of the desired platy talc were obtained. Further improvement in purity, however, is probably unnecessary but improved recovery is probably essential.

Flotation Test 8 (Oasis sample) was arbitrarily selected for a study of the mineral distribution in all products of a test. The results of this study are given in Table 3.

TABLE 3. FLOTATION RESULTS SHOWING MINERAL CONTENT
IN ALL PRODUCTS OF TEST 8 (OASIS SAMPLE)

Product	Weight Per Cent	Approximate Mineral Count, per cent			
		Platy	Nonplaty	Carbonate	Tremolite
Float 1	34.6	83	15	1	2
Cleaner Float	42.1	60	35	1	4
Cleaner Underflow	14.2	24	73	1	2
First Underflow	16.8	25	51	16	8
Composite*	100.0	55	38	4	3
Head Sample		48	43	5	4

* A close material balance was not obtained and for this reason the calculated distribution of the minerals is not included in this table. The reason for the lack of a satisfactory balance is probably due to the fact that the proper weight relationships cannot be assigned to the different minerals unless they are closely sized. It will be necessary to develop a systematic and rapid evaluating procedure if an accurate balance is required. The ultimate evaluation of the products will be more pronounced by measurement of their physical properties.

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Dr. W. H. Lyeon

January 24, 1958

An examination of the test products indicates that platy talc is selectively floated and a mineral count shows that the Float 1 product is 82 per cent platy talc. The carbonates are easily rejected and do not exceed one per cent of any of the test products except in the first underflow which contains 16 per cent carbonates. Tremolite and carbonates report predominantly in the first underflow; however, the rejection of tremolite is not as complete as the rejection of the carbonates.

After the encouraging flotation results were observed, it seemed necessary to establish that the enrichment of platy talc was the result of true flotation rather than a particle sizing effect. Samples of the flotation feed and the Float 1 product from the Oasis sample were screened on 200 mesh and the plus and minus 200-mesh fractions were evaluated with the microscope. The information obtained by this procedure is given in Table 4.

TABLE 4. MINERAL DISTRIBUTION IN SIZED FRACTIONS OF FLOTATION FEED AND FLOAT 1 PRODUCT OF TEST 8 (OASIS SAMPLE)

Product	Mesh, size	Weight Per Cent	Mineral Count, per cent			
			Platy Talc	Nonplaty Talc	Carbonates	Tremolite
Flotation Feed	-45+200	30	45	48	3	3
	-200	70	50	43	4	3
Float 1	-45+200	29	61	36	1	2
	-200	71	87	10	1	2

The data in Table 4 show clearly that the Float 1 product is improved in platy talc content in both size fractions. The plus 200-mesh fraction has been increased from 45 per cent platy talc to 61 per cent platy talc. The minus 200-mesh portion shows a significant improvement and has been increased from 50 per cent platy talc to 87 per cent platy talc. Because the grade improvement of the minus 200-mesh portion is so marked, it is implied that better flotation results might be obtained by grinding all of the feed through 200 mesh before flotation.

Two duplicate tests were made on Italian No. 2 talc which is 99 per cent minus 200 mesh. The float product of Test 7 represented 76.9 per cent of the feed and microscopic examination indicated that it was at least 96 per cent platy talc and about 3 per cent fibrous talc. The carbonate content was reduced from three per cent to less than one per cent and the tremolite content was less than one per cent.

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Dr. W. H. Lycan

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A comparison of Italian No. 1 talc (not beneficiated) with the Float 1 products obtained from the other samples shows the following mineral relationships:

	Per Cent Weight Recovered	Mineral Compt. per cent			
		Platy Talc	Nonplaty Talc	Carbonates	Tronolite
Italian No. 1	100.0	88-90	8-10	<2	Traces
Italian No. 2 (Float 1)	76.9	96	3	1	Traces
Stone Creek (Float 1)	29.9	85	12	1	2
Oasis (Float 1)	24.6	83	16	<1	1

It is noted in the foregoing data that the Float 1 product obtained from the Italian No. 2 sample is better than any of the other products relative to degree of platiness. The Stone Creek and Oasis products are not as pure as Italian No. 1 talc.

Beneficiation tests in the near future will be directed toward obtaining a higher recovery, without sacrificing quality, from the Italian No. 2 sample. Preliminary attention will be given to the filtering and drying characteristics of the enriched flotation products. Physical measurements will be made on the flotation products. Some attention will be given toward establishing a more accurate method of mineralogical evaluation.

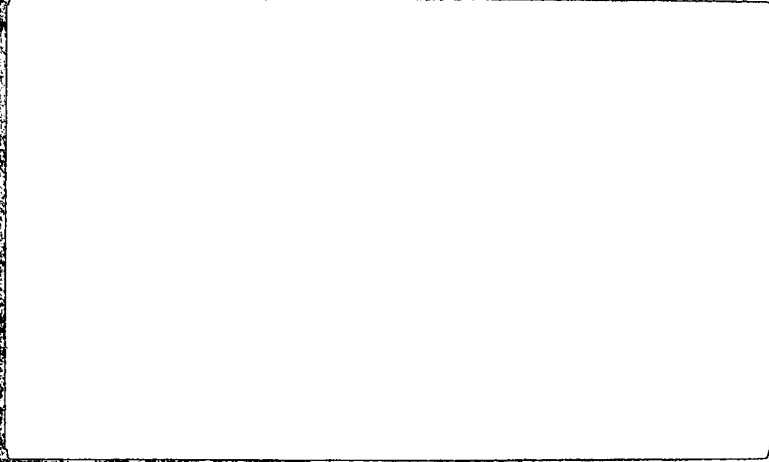
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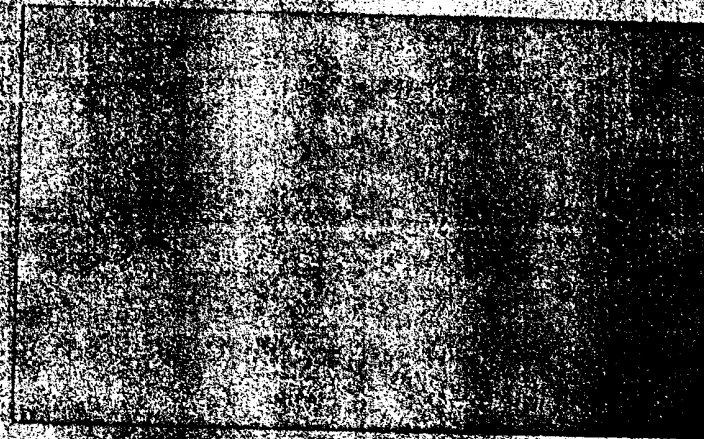
Whitman H. Brown

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Exhibit 44

PROXY REPORT





BATTELLE FIELDS OF RESEARCH

AERONAUTICAL ENGINEERING	ENVIRONMENTAL ENGINEERING
AGRICULTURAL SCIENCES	LIGHT ALLOYS AND RARE METALS
AIR AND STREAM POLLUTION CONTROL	MECHANICAL ENGINEERING
ANALYTICAL CHEMISTRY	METALLURGY
BIOCHEMISTRY	MINERALS PROCESSING
BIOPHYSICS	NONDESTRUCTIVE INSPECTION
CERAMICS	NUCLEONICS
CHEMICAL ENGINEERING	OPERATIONS RESEARCH
CORROSION TECHNOLOGY	ORGANIC CHEMISTRY
ECONOMICS	ORGANIC COATINGS
ELECTRICAL ENGINEERING	PETROLEUM ENGINEERING
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PROGRESS REPORT

on

FURTHER STUDIES ON THE MEASUREMENT
AND CORRELATION OF THE PHYSICAL
PROPERTIES OF TALC

to

JOHNSON AND JOHNSON

Russell C. Cope
May 9, 1958

by

W. L. Smith

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio

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S O S K I N G A V E N U E C O L U M B U S I , O H I O

July 18, 1958

Dr. W. H. Lycan
Director of Research
Johnson and Johnson
New Brunswick, New Jersey

Dear Dr. Lycan:

This letter transmits six copies of our report "Further Studies on the Measurement and Correlation of the Physical Properties of Talc".

This report, plus that of October 25, 1957, demonstrates that lubricity may be improved and abrasiveness lessened by the removal of the mineral contaminants from talc. A minimum number of physical-property measurements are recommended as important in the comparison of high-grade talcs and in the evaluation of improvement of physical properties through beneficiation.

Because of urgency on other phases of Battelle's investigation of talc, further studies on the physical properties are postponed.

We would be pleased to have your comments on our findings.

Very truly yours,

Wm. L. Smith
Principal Geologist
Minerals Beneficiation Division

WLS/djo
Enc. (6)

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FURTHER STUDIES ON THE MEASUREMENT
AND CORRELATION OF THE PHYSICAL
PROPERTIES OF TALC

by

W. L. Smith

ABSTRACT

To establish the interrelationships of the physical properties of talc and to be able to visualize the means of their improvement, it has been necessary to devise means of measuring small differences in properties. To determine the nature and effects of grit, a chemical analysis for small concentrations of carbonate minerals and a machine for measuring the relative abrasiveness of talc samples were contrived, and the measurements were compared with those of other physical properties. The various other measurements were made on standard laboratory instruments, using both sized fractions and whole powder. Physical-property measurements of the talc demonstrated that the samples which produced the least abrasion were those with the greater platy talc component and those with the least amount of contaminants. It is concluded that the improvement of slip and the lessening of abrasiveness may be accomplished by the removal of the mineral contaminants, but not by the removal of size fractions.

Preliminary work on color and reflectance properties is presented, and demonstrates a relationship to particle size and, hence, secondarily to other physical properties.

The report includes an appraisal of the various physical-property measurements employed in the evaluation of improvement of talcs. A minimum number of measurements are recommended as important in the consideration of beneficiation for improvement and for comparison of natural high-grade ores.

INTRODUCTION AND SUMMARY

This report is a continuation of the studies of the physical properties of talc, their measurement, and comparison^{(1)*}, previously reported to Johnson and Johnson. The first Progress Report dealt with petrography, lubricity, and such physical measurements as average diameter, bulk density, porosity, and surface area. It was concluded from the previous study that the acceptable Italian talc fell within a small range of physical measurements and that the samples with the more desirable slip have the greater surface area, the smaller average particle diameter, the greater ratio of voids to total volume, and the lesser bulk density. Lubricity was found to be controlled by the shape of the relatively small content of larger particles in an otherwise finer mixture. Removal of the coarser contaminants, or preferably of all of the contaminants, was concluded to be a means of improving the slip of the talc.

* References appear at end of report.

The conclusions of the previous progress report have been further substantiated by the following studies; however, since lubricity is but one of many of the properties of talc, the previous work represented but part of the picture. Whereas the previous report dealt primarily with the physical measurement of areas, diameters, weight, and directly related characteristics, this report deals with reflectance, color, moisture content, abrasiveness, alkalinity, and acid solubility - properties related to lubricity only through their common correlation through surface area, size, and component contamination.

As in the previous report, both particle size and shape and the amount and nature of the contaminants are investigated to determine the contributing factors to physical measurement variations. It is recommended as a result of these studies that the following measurements are sufficient to determine satisfactory talc within the range in composition of Italian talc. These are the determination of the mineralogy and particle size distribution, volumetric analysis of the carbonate component, and the measurements of the bulk density, moisture content, reflectance, and whiteness. This should also serve as a basis for the determination of acceptability in other talcs and beneficiated products, taking into consideration the differences in size distribution, crystallographic habit, and mineral contamination.

Because size distribution, as it is reported, is dependent upon the analytical procedure, the measurement of physical properties is made only on closely sized fractions in the coarser size ranges. Division into size fractions of the finer size portion of a powder which is composed of platelets is inaccurate by standard laboratory procedures and requires detailed petrographic examination of the products. A method proposed by R. W. Schatz⁽²⁾ which reports size distribution on the basis of theoretical spheres rather than on the basis of actual petrographic measurement serves as an excellent comparative measurement for powders with similar mineralogical and crystallographic composition. Of necessity, these figures show little resemblance to the measurements of the greater dimensions of the talc platelets. Consistent with the previous progress report, the particle-size-distribution data here presented are based on screened size fractions and the sizes given are those measured on a petrographic microscope.

As in the study of lubricity, in order to determine the improvement of specific physical properties, objective tests had to be devised to measure the small differences between acceptable talc and talc of lower quality. Until now, acid solubility was determined gravimetrically on the various talc samples. The small differences in per cent composition and per cent incidence of the carbonate component of Italian talc, and its close relationship to both abrasiveness and lubricity, required the development of an analysis for equivalent dolomite in low concentrations (Appendix B).

Abrasiveness has previously been measured subjectively, similar to lubricity. However, because subjective measurements are not correlative, and because small, often significant differences cannot be so measured, an abrasion machine was built. This device, does not give an absolute value to abrasion, however, it provides reproducible figures which are of relative value and which are correlative with measurements of other physical properties.

Except where otherwise noted, the measurements presented in this report were made on the same samples of "EGT Extra 00000" talc, obtained from the Cranford, New Jersey, plant, which were used in the work reported in the previous Progress Report on physical properties.

DISCUSSION OF ABRASIVENESS

A highly undesirable property of a talcum powder is abrasiveness or grittiness. Grit is undesirable in that it may scratch or otherwise irritate the skin, and even very small amounts of grit may quickly be noticed subjectively.

Grit consists of that portion of ground talc which is angular, or oversize, particularly in thickness. Grit includes both oversize and nonplaty talc particles as well as mineral contaminants. It occurs as aggregates of talc and contaminants, as acicular and fibrous particles of talc and amphibole, as shards and granules of amphibole or carbonate, and as prismatic grains of titanite, rutile, zircon, apatite, and other accessory minerals.

Where the grit is other than oversize talc, it has hardness and angularity sufficient to scratch. Talc which is oversize in its greater dimensions is rare in the samples studied. It is the product of incomplete grinding and may easily be removed on a 150-mesh screen. Talc which is oversize in thickness is of the nonplaty variety, the result of the incomplete alteration of pre-existing minerals or the formation of pseudomorphs after more equidimensional species. Such particles serve less as abrasives than as deterrents to proper slip. The 8 to 10 per cent of nonplaty talc in the Italian material is presumed to be derived from tremolite or enstatite. This mechanism is discussed in the reports on the Brazilian⁽³⁾ and Canadian⁽⁴⁾ talc deposits.

Whereas friction, as expressed in the sense of the translation movements of talc platelets over one another, produces the desirable property of slip, such friction is not a disruption of the free lamellar movement of the component particles of the powder nor a disruption of the free movement of the surfaces in contact. When, however, a lubricant fails to mask irregularities in the contacting surfaces or introduces asperities of its own, then point friction or plowing is initiated. Point friction and plowing are the sources of irritation or grittiness. Grit permits wear between the contacting surfaces by abrasion, either in the plowing or scratching mechanism of oversize and angular particles, or by the disruption of lamellar movement of the platelets which leaves areas unlubricated or introduces a damming-up and rolling of particles.

Although lubricity and abrasiveness may seem to be relative, or the presence of one may seem to preclude the presence of the other, no direct correlation should be expected between the two properties inasmuch as both are the functions of several variable factors. A decrease in grit, however, is certain to improve the lubricity of whole powders where particle size is not a controlling factor.

Idealized talc particles are rounded platelets which may be thought of as essentially two dimensional, the thickness being about 1/8 to 1/15 of the greater dimension, depending upon the crystalline nature of the mineral and the degree of subdivision attained. In the better grades of talc the greater dimensions of a platelet are nearly equal.

The Italian No. 1 talc contains from less than 1 per cent to about 3 per cent of contaminants. The contamination is natural and consists mostly of carbonate with minor amphibole and rare accessory minerals. The carbonate component has been identified petrographically as primarily dolomite ($\text{CaO} \cdot \text{MgO} \cdot 2\text{CO}_2$) plus a minor amount of probable magnesite ($\text{MgO} \cdot \text{CO}_2$). No calcite ($\text{CaO} \cdot \text{CO}_2$) was identified. The amphibole component has been established to be the variety tremolite ($2\text{CaO} \cdot 5\text{MgO} \cdot 8\text{SiO}_2 \cdot \text{H}_2\text{O}$).

Table 1 based on Table 2 of the previous Progress Report⁽¹⁾ lists the incidence of contaminants in the Cranford samples. Table 2 shows the distribution of the major contaminants in the different size fractions of Italian talc.

TABLE 1. PREVIOUSLY REPORTED⁽¹⁾ PER CENT CONTAMINATION IN TALC SAMPLED AT CRANFORD, NEW JERSEY

Incidence of Contaminants(a), per cent	Date Sampled
< 1	9-6-56, 9-12-56, 9-19-56
1	8-10-56, 9-27-56, 10-18-56, 11-6-56
1-2	10-4-56, 10-29-56
2	8-20-56, 8-28-56, 11-15-56, 12-22-56
2-3	10-12-56, 11-30-56

(a) Determined petrographically.

TABLE 2. THE DISTRIBUTION OF THE MINERAL CONTAMINANTS IN THE DIFFERENT PARTICLE-SIZE FRACTIONS OF ITALIAN TALC

Tyler Mesh Size	Incidence of Contaminants(a), per cent		
	Total	Dolomite	Tremolite
Unseparated	± 2	< 2	Trace
+200	< 1	< 1	0-trace
-200+250	1	1	0-trace
-250+270	1-2	1-2	Trace
-270+325	2	2	Trace
-325+400	2	2	Trace 1
-400	> 2	> 2	< 1

(a) Incidence determined petrographically.

Grit is present in all size fractions, being somewhat more abundant in the fines. In the coarser fractions the mineral contaminants and the talc particles which are over-size in thickness are most readily sensed subjectively. The presence of grit in the fines is largely masked to the senses by the presence of larger platelets. In this regard no solution to abrasiveness lies in the removal of entire coarse size fractions, inasmuch as the grit in the then remaining coarser fractions would be as readily noticeable subjectively and more abundant percentagewise. To remove the abrasive particles, it is necessary to remove both nonplaty talc and the mineral contaminants from the whole powder by such beneficiation methods as flotation⁽⁵⁾ and classification by cycloning⁽⁶⁾, the initial studies on which have been reported or are in preparation (Table 3).

TABLE 3. THE EFFECT ON LUBRICITY OF THE REMOVAL OF MINERAL CONTAMINANTS AND NONPLATY TALC FROM ITALIAN TALC SAMPLES

Talc Sample	Incidence of Indicated Particle Type ^(a) , per cent				Lubricity-Board Measurement, sec
	Platy Talc	Nonplaty Talc	Dolomite	Tremolite	
Italian No. 1					
Feed	88-90	8-9	< 2	< 1	0.990
Float	95	4	Trace	Trace	1.046
Italian No. 2					
Feed	90	5	3	2	0.926
Float	98	< 1	Trace	Trace	1.051

(a) Mineralogical incidence determined petrographically.

It is important to emphasize the difference between the incidence or frequency of contaminants and their per cent of total composition. The per cent incidence is determined petrographically by grain count. It is a two-dimensional measurement approximating area and does not consider the thickness of the particles observed. The incidence of a mineral or crystal type is of primary importance inasmuch as a powder consists of a mixture of discrete grains, each with its particular size, shape, and other physical properties. In considering the behavior of a powder as a lubricant, we are dealing with the mechanical interactions of individual grains in lamellar movement and thus are concerned with the frequency of types of grains, not with their per cent of total composition. That is, for example, in considering lubricity or abrasiveness we must deal with the incidence of individual particles of dolomite rather than with the total volume or weight per cent of the sample which is dolomite, except when dealing with closely sized samples. Conversely, when considering acid solubility, moisture content, and the analysis and evaluation of beneficiation products, we, of necessity, deal with total components, not the incidence of particles. While small differences in per cent incidence of contaminants in a powder may influence the physical properties of mechanical movement, in no case described here is the per cent incidence different from the weight per cent or the chemically analyzed component by more than 1 per cent of the whole sample.

THE MEASUREMENT OF ABRASIVENESS

Discussion

A standard method of measuring the abrasiveness of high-quality talc has not been devised previously. Abrasiveness or grit has been measured subjectively by testing samples between the fingers or teeth. As in the case of lubricity, the final analysis of acceptability in regard to abrasiveness is subjective: consumer reaction. Objective tests are not designed to replace the subjective tests; however, to be able to determine

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improvement in beneficiation procedures and to determine the correlative relationships of the physical properties of talc, it is necessary to be able to measure small differences in the physical properties and to be able to compare them to other quantitative measurements. Knowledge of these interrelationships serves as the basis for interpretation of improvement in quality and thus serves to make it possible to visualize methods of beneficiation.

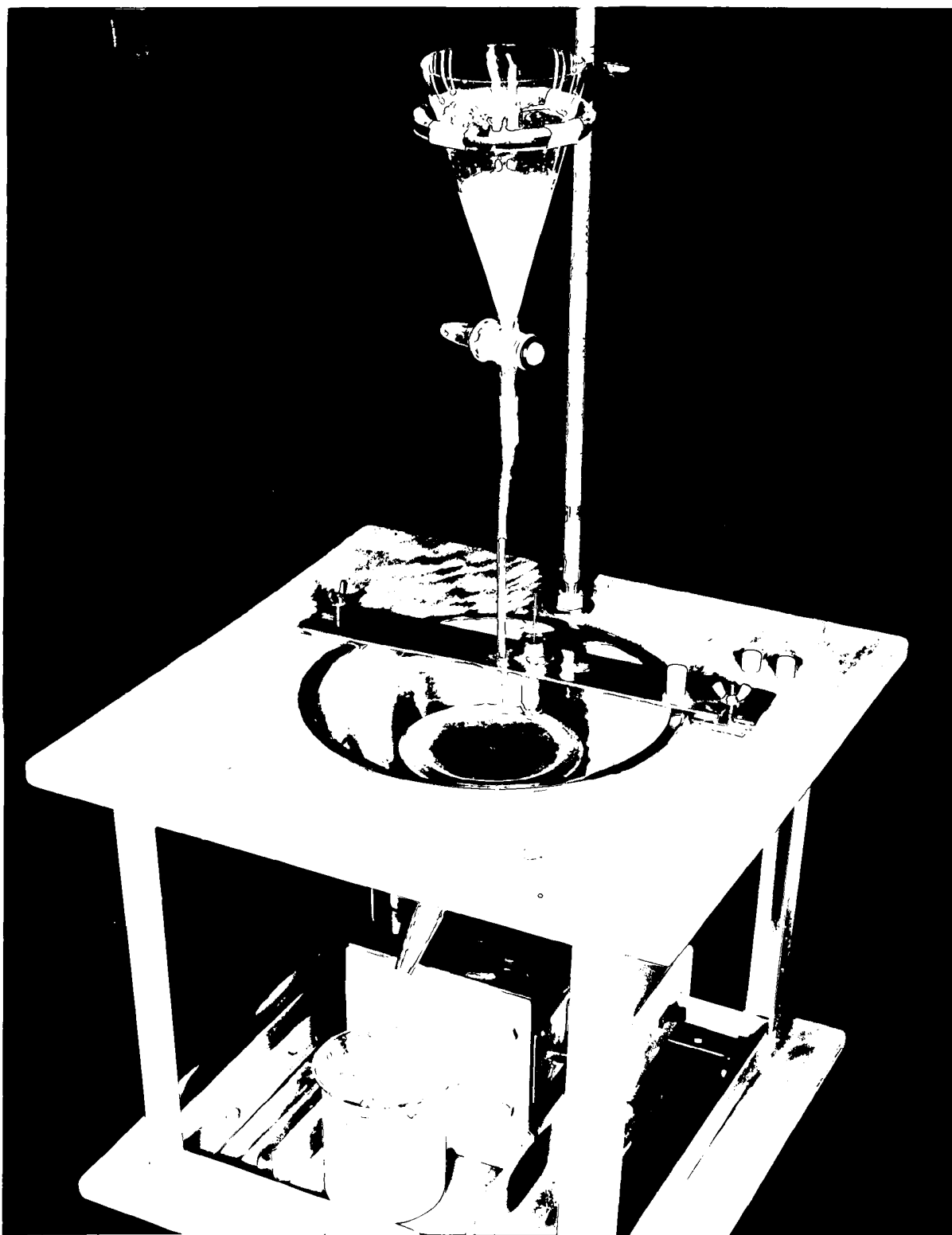
Since the subjective tests are of little help in measuring small differences in one of the many physical properties encountered, and since such tests have no basis for correlation, a machine was built to measure objectively, or test for, abrasiveness, apart from other physical properties.

The Abrasion Machine

Because it was necessary to measure small differences in the abrasiveness of talc, a machine was built to test the wear effect of small concentrations of grit on standard material. The machine was built of a 1/20-hp 1725-rpm electric motor mounted vertically and fitted with a 5-inch lap covered by a Buehler Microcloth held in place by a rubber belt. The lap portion of the machine is set into a steel bowl and covered with a plastic lid. Mounted on a ringstand over the lap a 500-ml open separatory funnel with stopcock is connected by a rubber tube with an adjustable pinch clamp to a feed spout. The separatory funnel contains the sample of talc to be tested in a slurry of 3 grams of talc to 350 ml of water. The feed spout and a cylindrical pellet holder are mounted in a removable crossbar over the lap. Accessibility to these parts is afforded through a hole in the plastic cover. Standard 1/2-inch-diameter pellets are held in the sample holder by a 16.1-gram weight to prevent their skipping or floating on the lap. A 1000-ml beaker mounted under a drain in the steel bowl catches the tested slurry. Figure 1 shows the over-all apparatus. Figure 2 shows the detail of the feed and abrasion mechanism. A detailed description of the abrasion machine and the technique of its operation are found in Appendix A.

In order to measure the abrasiveness of the talc in the slurry a test had to be designed where the object abraded would have a great enough loss to be measured physically. Since the abrasiveness to be measured was that of a powder containing generally from only 1 to 3 per cent of abrasive gangue particles, the material to be abraded had to have a hardness greater than that of the talc, less than that of the grit, and also had to be coherent and homogeneous. After testing a large number of materials it was decided to perform the bulk of the tests on pellets made of minus 400-mesh Italian talc pressed under 50,000-psi pressure. The pellets average 5.20 grams and have dimensions of 1/2 by 7/10 inch. The pellets have a hardness greater than that of the raw talc and less than that of the contaminants (Table 4). Carbonate pellets were made to test specifically for the rarer, harder components, in a similar manner, but using alcohol instead of water in the slurry.

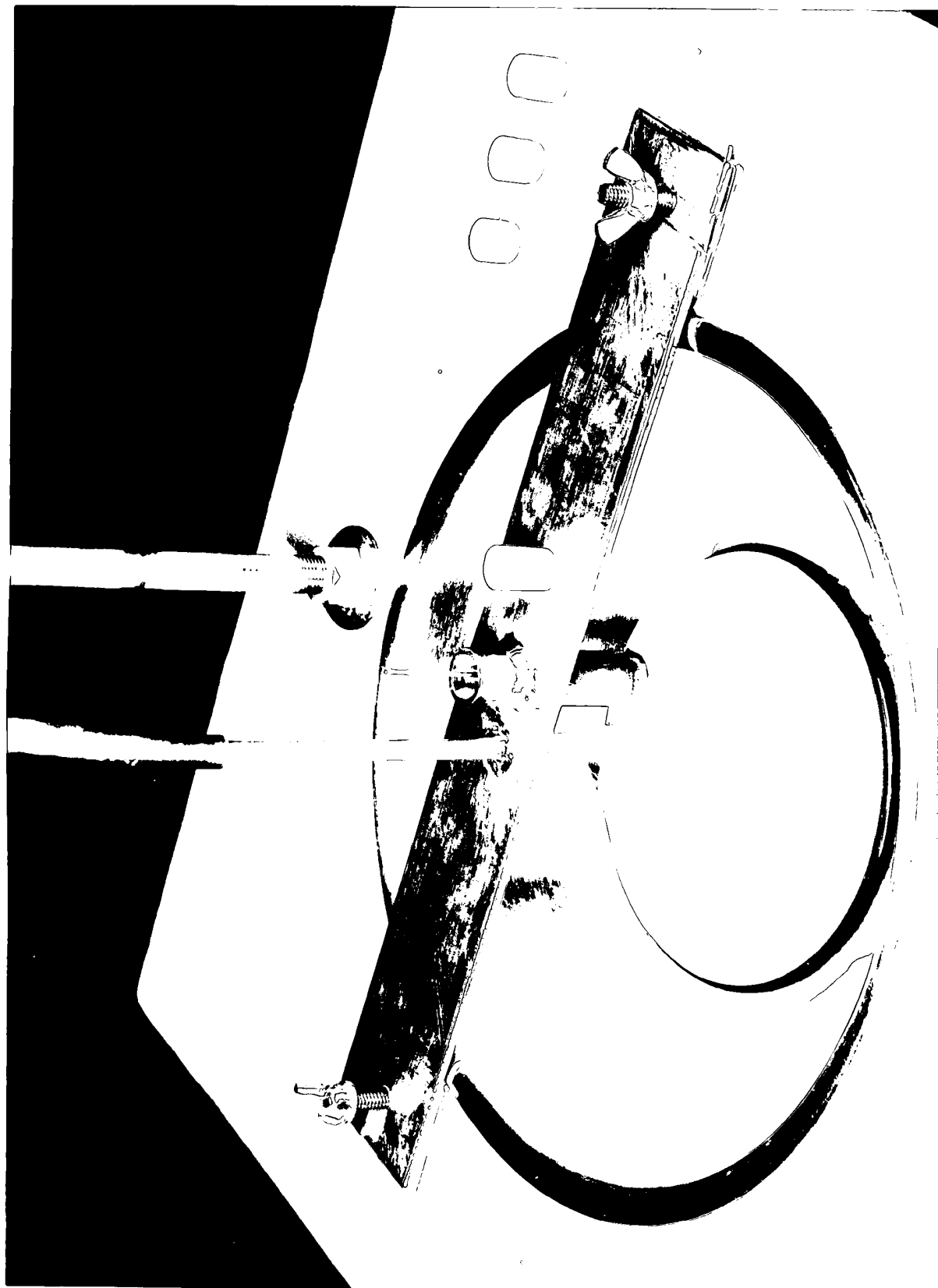
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FIGURE 1. THE ABRASION MACHINE SHOWING RESERVOIR CONTAINING
SAMPLE IN SLURRY TO BE TESTED FOR ITS ABRASIVENESS

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FIGURE 2. DETAIL VIEW OF ABRASION-MACHINE LAP SHOWING FEED SPOUT, CYLINDER IN WHICH PELLETS ARE HELD ON THE LAP, AND STANDARD PELLETS OF PRESSED TALC

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TABLE 4. RELATIVE HARDNESS OF THE TEST PELLETS AND THE GRIT PRESENT IN ITALIAN TALC

Mineral	Moh Hardness
Talc	1
Pressed-talc test pellet	± 2 (scratches talc)
Magnesite	3.5 (scratches talc pellet)
Dolomite	4
Pressed-carbonate test pellet	>4 (scratches dolomite)
Apatite	5 (scratches carbonate pellet)
Titanite	5
Tremolite	6
Rutile	6
Zircon	7.5

The abrasion-machine operation is timed electrically. The pellets are measured on a micrometer caliper before the test and afterward, after drying. The abrasion measurement is reported in decimal fractions of an inch per second. Although there are limitations to the use of a micrometer, the samples which were compared demonstrated differences in measurement large enough to be significant. Measurements based on weight were found to be entirely unsatisfactory inasmuch as some weight loss was due to spalling and abrasion of the pellet by the walls of the sample tube on portions other than that exposed to the lap and abrasive. This indicated losses which were no indication of the degree of loss due to action on the tested surface alone.

The abrasion machine subjects the standard pellet to abrasion by the sample of talc being studied, at a high rate of speed. It has been calculated that the pellet receives wear equivalent to being rubbed over more than 1800 ft/min of surface of the talc being tested. As expected, the abrasion machine demonstrates that the slurry samples with the greater incidence of mineral contaminants produce the greater amount of abrasion on the pressed pellets. It is also shown that those samples with primarily platy habit are less abrasive than those containing effective amounts of nonplaty talc.

More precise abrasion machines could be built; however, the device used is satisfactory for the purpose of comparing samples within the range of those tested and is an adequate means of obtaining comparable measurements of the effect of grit. Typical figures obtained by the abrasion experiments are shown in Table 5.

TABLE 5. TYPICAL FIGURES OBTAINED BY ABRASION TESTS ON FOUR SAMPLES OF ITALIAN TALC

Test	Incidence of Contaminants(a), per cent	Pellet Measurements, in.		Difference in Measurements, in.	Time, sec	Abrasion(b), 10^{-3} in./sec
		Before	After			
1	2	0.6453	0.5566	0.0887	38	2.33
2	2	0.6435	0.5483	0.0952	41	2.32
3	2	0.6184	0.5374	0.0810	36	2.25
4	2	0.6442	0.5699	0.0743	32	2.32

(a) Determined petrographically.

(b) Significant figure: 2.3×10^{-3} in./sec.The Abrasiveness of Talc Samples

Fifteen samples of talc collected at the Cranford plant of Johnson and Johnson, the same samples used in the previously reported lubricity experiments⁽¹⁾, were tested on the abrasion machine. The results of the measurements are shown in Table 6. The measurements show a range of from 1.62 to 2.69×10^{-3} in./sec wear on the standard pellets. These figures are generally correlative with the incidence of contaminants, as determined petrographically, as reported in the Progress Report dealing with lubricity⁽¹⁾. As it will be shown further in the report, this relationship only holds in whole unseparated powder where particle size is not a fundamental controlling factor. The correlation of lubricity-board measurements with contamination reported in Table 2 of the previous Progress Report⁽¹⁾ shows a similar general relationship between contamination and lubricity. Where the lubricity experiments concluded that the samples containing the greater amount of contaminants demonstrated the poorer lubricity, the abrasion-machine experiments show that the samples with the greater contamination produce the greater amount of abrasion. Thus, when dealing with whole, unscreened powders, the removal of grit should also serve to improve lubricity.

Although the removal of grit improves the lubricity of whole powders, the relationship of lubricity to abrasiveness cannot be considered to be mathematically inverse. The properties which control abrasiveness are the size and shape of the contaminants and their incidence in the coarser fractions; whereas, the properties which control lubricity are the over-all size distribution, those previously described properties directly related to surface area, plus the incidence of the coarser components. When measuring screened fractions of powders both abrasiveness and lubricity are influenced by the specific particle size, and abrasiveness will be directly related to the grit component, whereas in whole powders the finer abrasive particles will be in part masked by the coarser platelets.

To test further the effect of contaminants upon abrasiveness, the contaminants were removed from a sample of talc by froth flotation and the products were tested on the abrasion machine. The same samples had previously been tested for lubricity⁽¹⁾. The test results, which are noticeable subjectively, are reported in Table 7.

TABLE 6. RELATION OF PURITY OF SAMPLE TO ABRASIVENESS AND LUBRICITY IN WHOLE POWDER

Date Sampled	Abrasiveness, 10 ⁻³ in. / sec	Incidence of Contaminants ^(a) , per cent	Lubricity-Board Measurement, sec
9-12-56	1.62	< 1	1.030
8-10-56	1.70	1	1.021
9-19-56	1.84	< 1	1.028
9-6-56	1.87	< 1	1.083
10-18-56	1.88	1	1.025
9-27-56	1.90	1	1.017
10-4-56	1.90	1-2	0.982
8-20-56	1.91	2	0.971
8-28-56	1.97	2	1.007
11-6-56	2.15	1	1.053
11-15-56	2.30	2	0.936
10-29-56	2.32	1-2	1.006
11-30-56	2.32	2-3	0.952
10-12-56	2.59	2-3	0.968
12-22-56	2.69	2	0.965

(a) Previously reported⁽¹⁾, determined petrographically.

TABLE 7. ABRASION AND LUBRICITY MEASUREMENTS ON FLOTATION PRODUCTS OF ITALIAN NO. 1 TALC

Product	Abrasiveness, 10 ⁻³ in. / sec	Lubricity-Board Measurement, sec
Starting sample	2.14	0.990
Float product ^(a)	1.50 (superior) ^(c)	1.046 (superior)
Nonfloat product ^(b)	3.03 (inferior)	0.873 (inferior)

(a) Essentially pure talc, representing 90 per cent of starting sample.

(b) 85 per cent talc, 15 per cent contaminants, representing 10 per cent of starting sample.

(c) Less abrasive float products have been made from Italian No. 2 talc.

The float products clearly demonstrate superiority over the starting sample in regard to both abrasiveness and lubricity. The deleterious effect of contaminants is shown by the inferior measurements derived from testing the reject product of the flotation process.

THE RELATIONSHIP OF ABRASIVENESS TO PARTICLE-SIZE DISTRIBUTION AND CONTAMINATION

Discussion

The abrasiveness of the talc studied is determined by its component grit. When dealing with the mechanics of a powder in lamellar motion, we are dealing with the interrelationship of individual particles, and thus are concerned with the per cent incidence and particular sizes and shapes of individuals. The distribution of the contaminants and nonplaty talc in the different size fractions is thus a primary consideration. The coarse contaminants are those which scratch and are quickly noticed subjectively. The finer contaminants clog the lamellar movement of the talc platelets and initiate rolling of the powder, introducing aggregate asperities.

In the previous reports to Johnson and Johnson^(1, 2, 7) the problem of particle-size distribution has been thoroughly discussed. It does not seem requisite here but to re-emphasize the importance of establishing the particle-size distribution of a powder when studying its physical properties or the means of their improvement. Since the size of the abrasive particles, as well as their incidental abundance, contributes to abrasiveness, it was necessary to determine the size distribution of the contaminants.

Correlation of Abrasiveness With Particle-Size Distribution and Contamination

Portions of the same samples which were used to test for lubricity and other physical properties were used in the following experiments on abrasiveness. Size fractions were made of Italian talc and were measured for their abrasiveness on the abrasion machine. Results of the experiments show that the finer particle-size fractions are more abrasive than the coarse. This is in agreement with the incidence of grit determined petrographically. Chemical analyses for equivalent dolomite on these samples are also in agreement. These analyses appear in the section of this report dealing with acid solubility.

Table 8 shows the results of abrasion tests of size fractions on standard talc pellets. When comparing size fractions a parallel relationship exists between lubricity and abrasiveness, as a function of particle size. Thus, were only the fines, the most lubricous fraction, used for baby powder, this fraction would also be the most abrasive. In order to retain the more lubricous particles yet remove the more abrasive, it is necessary to remove the contaminants only. Both lubricity and grittiness cannot be improved by the removal of particle-size fractions.

TABLE 8. RELATIONSHIP OF ABRASIVENESS AND LUBRICITY TO PARTICLE SIZE AND CONTAMINATION IN SIZE FRACTIONS OF ITALIAN NO. 1 TALC

Tyler Mesh Size	Abrasiveness, 10 ⁻³ in./sec	Lubricity-Board Measurement, sec	Incidence of Contaminants(a), per cent		
			Total	Dolomite	Tremolite
Unseparated	2.14	0.990	±2	<2	Trace
+200	1.30	0.889	<1	<1	0-trace
-200+250	1.59	0.951	1	1	0-trace
-250+270	1.72	0.980	1-2	1-2	Trace
-270+325	2.00	1.030	2	2	Trace
-325+400	2.33	1.043	2	2	Trace-1
-400	2.48	1.099	>2	>2	<1

(a) Determined petrographically.

In order to show which effects are primary, and which are secondarily related because sized materials are analyzed, tests were made on the plus 200-mesh fraction of the talc as received from Italy, on the minus 400-mesh fraction, and on the plus 200-mesh material after it was crushed to pass a 400-mesh screen. The natural plus 200-mesh material had but a trace of contaminants compared with the more than 2 per cent present in the natural minus 400-mesh fraction. Abrasiveness and lubricity tests (Table 9) show clearly that the abrasiveness is controlled primarily by the contamination and only secondarily by the size fraction analyzed. It also shows that the lubricity is controlled primarily by the particle-size fraction tested, and only secondarily by the contamination present in the specific size range. This experiment serves as the basis of interpretation for relating the physical properties of sized material, and also establishes the controlling factors behind lubricity and abrasiveness in whole powders.

TABLE 9. COMPARISON OF LUBRICITY AND ABRASIVENESS TO GRAIN SIZE AND CONTAMINATION

Sample	Abrasiveness, 10 ⁻³ in./sec	Lubricity-Board Measurement, sec	Incidence of Contaminants(a), per cent
Natural +200-mesh fraction	1.30	0.889	Trace
Natural -400-mesh fraction	2.48	1.099	>2
+200-mesh fraction ground to -400 mesh	1.12(b)	1.108(c)	Trace

(a) Determined petrographically.

(b) The abrasiveness of this sample is only slightly less than that produced by the same sample prior to grinding, much less than the natural minus 400-mesh fraction which contains more grit.

(c) The lubricity of this sample is greatly improved by regrinding, but it is essentially like the natural minus 400-mesh sample despite the difference in the grit present.

TABLE 10. ABRASIVENESS AND LUBRICITY MEASUREMENTS OF ITALIAN TALC SAMPLES FROM WHICH SPECIFIC PARTICLE-SIZE FRACTIONS HAVE BEEN REMOVED

X Represents Fractions Removed From Whole Powder
U Represents Fractions Tested

Tyler Mesh Size	Incidence of Contaminants (a), per cent	Lubricity-Board (b) Measurement of Size Fractions, sec	Abrasiveness, 10^{-3} in./sec			
			Test 1	Test 2	Whole Powder	Test 3 Test 4
+200	<1	0.889	U	U	U	X X
-200+250	1	0.951	U	U	U	X X
-250+270	1-2	0.980	U	U	U	X U
-270+325	2	1.030	X	U	U	U U
-325+400	2	1.043	X	U	U	U U
-400	>2	1.099	X	X	U	U U
Lubricity-Board Measurement, sec			0.945	0.963	0.990	1.038 1.068
Abrasiveness, 10^{-3} in./sec						
			1.88	1.88	2.14	2.27 2.34
Approximate Weight Per Cent of Fractions Removed						
			97.0	82.0	0.0	2.0 3.0

—————Increase in slip and abrasiveness—————→

(a) Determined petrographically.
(b) Based on Table 10 of previous report(1).

In the previous study of lubricity⁽¹⁾, measurements were made on powders from which different size fractions had been removed, and on mixtures of specific size fractions. The experiment demonstrated that the over-all lubricity was influenced primarily by the coarser particles. Similar experiments on abrasiveness have been made and show that it is not possible to increase the lubricity by removing total size fractions without increasing the abrasiveness (Table 10).

Because talc contains tremolite and rare accessory minerals as well as carbonate as abrasive components, a test was devised to measure the abrasiveness of the harder contaminants. Carbonate pellets were made by fusing a three-to-one mixture of sodium carbonate and sodium borate into a melt. The fusion product was crushed and pressed into pellets under 15,000 psi. The resulting pellets were harder than the talc or the carbonate contaminants but softer than the tremolite and accessory minerals. The pellets were slowly soluble in water; therefore, alcohol was used as the fluid in the test slurries. The test results are not necessarily correlative with measurements made on talc pellets, but demonstrate the distribution of the harder contaminants (Table 11). All other abrasive data contained in this report have been determined on pressed talc pellets.

TABLE 11. THE DISTRIBUTION OF THE CONTAMINANTS HARDER THAN CARBONATE IN ITALIAN TALC AS SHOWN BY ABRASION TESTS MADE ON CARBONATE PELLETS

Tyler Mesh Size	Abrasiveness (on Talc Pellets), 10 ⁻³ in. /sec	Abrasiveness (on Carbonate Pellets), 10 ⁻³ in. /sec	Incidence of Contaminants ^(a) , per cent		
			Total	Dolomite	Tremolite
Unseparated	2.14	0.9	± 2	< 2	Trace
+200	1.30	0.5	< 1	< 1	0-trace
-200+250	1.59	0.7	1	1	0-trace
-250+270	1.72	0.6	1-2	1-2	Trace
-270+325	2.00	0.6	2	2	Trace
-325+400	2.33	0.8	2	2	Trace-1
-400	2.48	0.9	> 2	> 2	< 1

(a) Determined petrographically.

To demonstrate the effect of the rarer contaminants on the abrasion of pressed talc pellets, a series of sized fractions of Italian talc were leached free of the carbonate components and measured on pressed talc pellets. Table 12 shows the degree of abrasiveness produced by the leached samples.

TABLE 12. ABRASION TESTS USING LEACHED AND UNLEACHED SIZED FRACTIONS, DEMONSTRATING THE EFFECT OF DOLOMITE ON ABRASIVENESS

Tyler Mesh Size	Abrasion, 10^{-3} in./sec	
	Unleached Powder	Leached Powder
Unseparated	2.14	1.50
+200	1.30	1.34
-200+250	1.59	1.60
-250+270	1.72	1.72
-270+325	2.00	1.71
-325+400	2.33	1.90
-400	2.48	1.75

An additional test, not relative to the beneficiation of Italian talc, but designed as an experiment to serve as a basis for study of lower grade talc, was made on a series of mixtures of Italian talc and minus 400-mesh calcium carbonate (Table 13). Although the data are not to be considered correlative with those of Italian talc, they demonstrate clearly the increasing effect of contamination on abrasion.

TABLE 13. ABRASIVENESS OF MIXTURES OF ITALIAN TALC AND CALCIUM CARBONATE

Per Cent Italian Talc(a)	Per Cent CaO·CO ₂ (-400 Mesh)	Abrasion, 10^{-3} in./sec	Difference in Abrasion, 10^{-3} in./sec
100	0	2.14	0.75
90	10	2.89	2.20
50	50	5.09	3.08
10	90	8.17	5.48
0	100	13.65	

(a) Contains about 2 per cent native carbonate.

MEASUREMENT AND CORRELATION OF OTHER PHYSICAL PROPERTIES

Moisture Content

The previous Progress Report⁽¹⁾ introduced the problem of moisture content in talc, suggesting that the fine-grain-size fractions should adsorb more moisture on its greater surface area per unit of weight. Table 14 shows the moisture content of size fractions of Italian talc, demonstrating an increase in moisture content with decreasing particle size. Because of the relationship of particle size to other physical properties,

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the moisture content of the sized fractions was found to be apparently correlative with a number of other measurements, indicating coincidental relationships which would not hold true in unsized samples.

TABLE 14. RELATIONSHIP OF MOISTURE
CONTENT TO PARTICLE SIZE
IN ITALIAN TALC

Tyler Mesh Size	Per Cent Moisture(a)
Unseparated	0.05
+200	0.01
-200+250	0.03
-250+270	0.03
-270+325	0.04
-325+400	0.05
-400	0.06

(a) Moisture content determined by method outlined in Johnson and Johnson's Raw Materials Specifications sheet.

The lubricity of talc is related to its moisture content insofar as the moisture content of the finer fractions is higher. In lower grade talc the moisture content was found to be much higher. Six domestic talcs, fabricated to a particle-size distribution similar to that of the Italian talc, showed from 0.08 to 0.20 per cent moisture on analysis. The higher moisture content of some inferior talcs requires that moisture be determined on samples prior to testing for lubricity. Moisture tends to make talc pasty, producing a false indication of superior lubricity on the lubricity board. To demonstrate that the 0.05 per cent moisture content of Italian talc did not affect the lubricity, tests were run on talc from which the moisture had been driven off. A nonreproducible difference of only 0.006 second was recorded, and is not considered to be a significant figure.

To further test the correlation of moisture content and particle size, the talc samples collected at Cranford were analyzed and the data compared with the percentage of fines in the sample. Table 15 compares the moisture content and the percentage of the powder finer than 400 mesh, as compiled from Table 6 of the previous Progress Report⁽¹⁾. The samples with the greater component of fines were found to contain the greater moisture content. No absolute interpretation should be given this relationship. The figures are all very close and their similarity is of greater importance than the correlation. However, there is a theoretical basis for the variance, and the data are presented for whatever they may be worth in the light of future studies. The correlation seems more than coincidental. Moisture content shows no other correlation in whole powders.

Inasmuch as the lubricity-board studies⁽¹⁾ showed that the lubricity variations depended upon the coarser fractions, the small difference in the fine component as related to moisture content should have no expression in lubricity.

TABLE 15. THE RELATIONSHIP OF MOISTURE CONTENT TO PER CENT OF MINUS 400-MESH PARTICLES IN WHOLE SAMPLES OF TALC COLLECTED AT CRANFORD

Per Cent Fines ^(a) (-400 Mesh, Tyler)	Per Cent Moisture	Date Sampled
88.28	0.06	8-28-56
88.16	0.07	9-27-56
87.26	0.06	9-6-56
86.61	0.06	11-6-56
86.09	0.05	9-19-56
85.29	0.05	8-20-56
83.91	0.05	10-18-56
83.40	0.05	12-22-56
83.04	0.05	10-4-56
82.93	0.03	9-12-56
82.57	0.03	11-30-56
82.28	0.04	11-15-56

(a) Repeated from previous report⁽¹⁾.

Johnson and Johnson's Raw Materials Specifications sheet states 0.15 per cent moisture content to be the tolerable upper limit. The Cranford samples, as well as the size fractions, contain considerably less moisture. This indicates that any beneficiation which would change the size distribution, hence the moisture content, would not produce a product of unsatisfactory moisture content.

Inasmuch as a pasty consistency in talcum powder would be undesirable, samples which by exposure or otherwise have taken on excess moisture must be restored by proper drying. One problem arising from flotation experiments was the tendency for the products to agglomerate after drying. It is possible that this moisture can be removed by spray drying. The problem of proper drying is to be considered further in the beneficiation phase of the program.

Absorptive Power

A physical property closely related to moisture content and particle size is the absorptive power of talc. The hygroscopic property is highly important, inasmuch as it is a factor in deodorizing, coloring, in the carrying of perfume or other agents, and in the retention of moisture. Because this subject is only partly understood at this time, it will not be reported on here. The property is not immediately pertinent to the other mechanical and physical relationships in this report except through moisture content.

Alkalinity

The 15 samples of Italian talc collected at Cranford were measured for pH on a Beckman pH meter standardized at neutrality and checked with Beckman buffer solutions of pH 7 and pH 10. The figures are accurate to about 0.1. The samples were prepared by mixing 5 grams of talc with 10 cc of distilled water (pH 6.9). The solutions were agitated and permitted to stand for 2 hours prior to their measurement. The pH of the Cranford samples ranges from 9.0 to 9.3 (Table 16).

TABLE 16. pH OF CRANFORD SAMPLES

Date of Sample	pH
8-10-56	9.1
8-20-56	9.0
8-28-56	9.3
9-6-56	9.1
9-12-56	9.1
9-19-56	9.2
9-27-56	9.2
10-4-56	9.2
10-12-56	9.2
10-18-56	9.0
10-29-56	9.1
11-6-56	9.3
11-15-56	9.0
11-30-56	9.1
12-22-56	9.2

To see if there was any relationship of pH to other physical properties, a Cranford sample with a pH of 9.2 was sized and the fractions were measured (Table 17). The size fractions each measured 9.2, which showed that within the precision of the instrument there was no difference due to particle size or variation in the concentration of carbonates. Studies in progress will determine the practicality of removing the dolomite to the degree that the pH will be lowered. Effective lowering of the pH would lessen Johnson and Johnson's expense of the acid additive.

TABLE 17. pH OF SIZE FRACTIONS OF ITALIAN TALC

Tyler Mesh Size	pH
Unseparated	9.2
+200	9.2
-200+250	9.2
-250+270	9.2
-270+325	9.2
-325+400	9.2
-400	9.2

Acid Solubility

Acid-solubility measurements were made as a part of the study of the carbonate component of Italian talc. It has been demonstrated that carbonate comprises the major amount of the contamination and that its removal decreases abrasiveness and improves lubricity.

The per cent solubility was first determined gravimetrically by the method outlined in Johnson and Johnson's Raw Materials Specifications sheet. The figures obtained were considerably lower than the 6 per cent solubility limit permitted by the specifications; however, they were greater than the figures anticipated from the small amount of carbonate minerals observed petrographically. Solubility analyses determined gravimetrically ranged from 2.10 to 2.81 per cent, showed no relation to any of the physical property measurements. It was assumed that there was either a greater amount of soluble matter in the impalpable fine fraction, or that there was a constant large sample loss during handling.

To resolve the problem the carbonate component was determined petrographically to be primarily dolomite, and a volumetric method of analysis was devised to analyze closely for small concentrations of dolomite in talc (Appendix B). The figures derived from these methods and computations are presented in this report as "equivalent dolomite". It is the measure of the total per cent of dolomite in the sample, not its incidence, which is a function of grain size. The equivalent dolomite analysis is recommended as a substitute for the previously used gravimetric analysis. The method is adjustable for larger concentrations, and other computations may be substituted when carbonates other than dolomite are present.

Equivalent dolomite is correlative with petrographically observed contamination and with related physical properties both in size fractions and in whole powder. A grab sample of Italian talc from the large bulk sample obtained from Cranford, containing slightly higher than average contamination, was analyzed for equivalent dolomite. The analysis showed 1.87 per cent. To check the analyzed percentage against the incidence, a series of grain counts was made on separate immersions, running 1.8, 1.8, 2.0, 1.8, 1.9, and 1.9 per cent. The average 1.8+ is essentially the same as the 1.87 per cent

determined volumetrically. In other cases a concentration of dolomite in the coarse sizes cuts down incidence, as a concentration of dolomite in the fines increases incidence. In the consideration of contaminants in regard to flotation, or of the measurement of lubricity or abrasiveness, the actual incidence of the contaminants is the important consideration. Within the range of Italian No. 1 talc, however, the difference is usually small.

Table 18 shows a comparison of the gravimetric and equivalent dolomite analyses, the incidence of contaminants, and lubricity, as listed against increasing abrasiveness. Table 19 shows contamination and equivalent dolomite compared with decreasing lubricity. These show the primary relationship between abrasion and contamination, and the secondary relationship of abrasiveness to lubricity in whole powders. This was also demonstrated by Table 9 of this report. Table 20 compares the equivalent dolomite, contamination, abrasiveness, and lubricity of sized fractions of Italian talc, demonstrating that the fines contain the more abrasive particles.

Inasmuch as the carbonate in the Italian talc constitutes a rare component in all size fractions, its removal by sizing is not practical. Any practical beneficiation process would be concerned with effectively removing the carbonate from the whole powder, thus improving the slip while eliminating the major abrasive. The effects of flotation on lubricity, abrasiveness, and contamination are presented in a report⁽⁸⁾ on the beneficiation of Italian No. 2 talc.

REFLECTANCE AND WHITENESS

Discussion

The terminology of properties involving the behavior of light is very complex and for the purposes of this report the discussion will be limited to reflectance, whiteness, and gloss. Reflectance is the measurement of the return of light off of a surface in ratio to the intensity of the incident light. This may be measured in terms of brightness, apart from color. Whiteness may be measured in either terms of reflectance over the whole spectrum as "lightness", or in the sense of the absence of specific colors. Gloss is the measure of shininess of surface or specular reflection, as distinct from total reflection.

Gloss, closely related to reflectance and whiteness, will be discussed in a future report when ample samples are prepared to enable assessment of the factors which control the property. Gloss is a separate measurement from those here reported.

Although one may visualize the differences between whiteness, lightness, brightness, and gloss, one cannot subjectively differentiate one from another with any precision or determine the contribution of a specific property to over-all effect. The important consideration is the total subjective effect, which is quickly noticeable. However, in figuring means of improving the over-all effect we must relate the contribution of particle size, shape, and specific contamination to both the over-all effect and to specific properties. For example, fibrous talc is white, but less reflective than platy talc. Rutile is highly reflective, but not white. The beneficiation studies designed to

TABLE 18. COMPARISON OF THE GRAVIMETRIC AND VOLUMETRIC ANALYSES FOR DOLOMITE AND THE RELATIONSHIP OF EQUIVALENT DOLOMITE TO THE INCIDENCE OF CONTAMINANTS AND LUBRICITY, AS LISTED AGAINST INCREASING ABRASIVENESS

Date of Granford Sample	Abrasiveness, 10-3 in./sec	Incidence of Contaminants(a), per cent	Equivalent Dolomite (Volumetric), per cent	Acid Solubility(b) (Gravimetric), per cent	Lubrity-Board Measurement(b), sec
9-12-56	1.62	<1	1.5	2.14	1.030
8-10-56	1.70	1	1.5	2.47	1.021
9-19-56(c)	1.84	<1	1.7	2.61	1.028
9-6-56	1.87	<1	1.6	2.64	1.083
10-18-56	1.88	1	1.6	2.44	1.025
9-27-56	1.90	1	1.6	2.39	1.017
10-4-56	1.90	1-2	1.6	2.10	0.982
8-20-56	1.91	2	1.7	2.71	0.971
8-28-56	1.97	2	1.6	2.51	1.007
11-6-56	2.15	1	1.6	2.57	1.053
11-15-56	2.30	2	1.6	2.27	0.936
10-29-56	2.32	1-2	1.6	2.78	1.006
11-30-56	2.32	2-3	1.7	2.81	0.952
10-12-56	2.59	2-3	1.7	2.58	0.968
10-22-56	2.69	2	1.7	2.30	0.965

(a) Determined petrographically.

(b) No relationship demonstrated.

(c) Petrographically found to contain rare but coarse dolomite.

TABLE 19. EQUIVALENT DOLOMITE, ABRASIVENESS, AND PER CENT CONTAMINATION
LISTED AGAINST DECREASING LUBRICITY

Date of Cranford Sample	Lubricity-Board Measurement, sec	Incidence of Contaminants(a), per cent	Equivalent Dolomite (Volumetric), per cent	Abrasiveness(b), 10-3 in. / sec
9-6-56	1.083	<1	1.6	1.87
11-6-56	1.053	1	1.6	2.15
9-12-56	1.030	<1	1.5	1.62
9-19-56(c)	1.028	<1	1.7	1.84
10-18-56	1.025	1	1.6	1.88
8-10-56	1.021	1	1.5	1.70
9-27-56	1.017	1	1.6	1.90
8-28-56	1.007	2	1.6	1.97
10-29-56	1.006	1-2	1.6	2.32
10-4-56	0.982	1-2	1.6	1.90
8-20-56	0.971	2	1.7	1.91
10-12-56	0.968	2-3	1.7	2.59
12-22-56	0.965	2	1.7	2.69
11-30-56	0.952	2-3	1.7	2.32
11-15-56	0.936	2	1.6	2.30

(a) Determined petrographically.

(b) None, or poor correlative relationship.

(c) Petrographically found to contain rare but coarse dolomite.

B A T T E L L E M E M O R I A L I N S T I T U T E

TABLE 20. COMPARISON OF CONTAMINATION, EQUIVALENT DOLOMITE, ABRASIVENESS, AND LUBRICITY IN SIZE FRACTIONS OF ITALIAN TALC

Tyler Mesh Size	Incidence of Contaminants(a), per cent		Equivalent Dolomite (Volumetric), per cent	Abrasiveness, 10^{-3} in. / sec	Lubrity-Board Measurement, sec
	Total	Dolomite			
Unseparated	±2	<2	Trace	1.9	2.14
+200	<1	<1	0-trace	0.6	1.30
-200+250	1	1	0-trace	1.1	1.59
-250+270	1-2	1-2	Trace	2.0	1.72
-270+325	2	2	Trace	2.0	2.00
-325+400	2	2	Trace-1	2.1	2.33
-400	>2	>2	<1	2.1	2.48
					0.990
					0.889
					0.951
					0.980
					1.030
					1.043
					1.099

(a) Determined petrographically.

remove specific particle sizes, shapes, or contaminants, in order to improve the appearance of the talc, will be best controlled when the reflectance and color properties can be assigned to particular components of the powder. As in the lubricity and abrasiveness studies, when the causes of variations are determined, it becomes possible to visualize the means of improving the subjective property.

The reflectance properties of talc begin a new category of measurements. The reflectance properties are distinct from other physical measurements insofar as direct relationships are concerned, except when particle size, surface area, and purity are concerned, as the following experiments demonstrate.

It is apparent at this stage of the investigation that some degree of over-all appearance can be controlled by the selective removal of particular particles.

The Measurement of Reflectance and Whiteness

The Italian talc is nearly pure white and highly reflective. The work under way on reflectance and whiteness is designed to devise a means of improving these properties, particularly in lower grade talc, as the result of interpreting their variations in response to the variations of other physical properties. The program includes determining the effect on whiteness and reflectance of the removal of specific sizes, shapes, and contaminants by beneficiation.

To date the measurements include only those made on a Photovolt Photoelectric Reflection Meter* and on a Gardner Color Meter**. The Photovolt instrument measures diffuse reflectance in terms of "whiteness" or luminous apparent reflectance (LAR). Whiteness in this sense is a matter of lightness without regard to color. A green tristimulus filter is used in the measurement, a standard procedure which permits interlaboratory comparisons. The instrument is calibrated against standard enamel and porcelain plates. The LAR of the Cranford samples is presented in Table 21, showing a range in measurement of 95.0 to 97.5, with no discernible relationship to other properties of the whole powder.

To determine the relationship between LAR and particle size, measurements were made on size fractions, which demonstrated greater reflectance in the fines (Table 22). This indicates that particle size and surface area are important factors. To test if particle shape is also a factor, measurements were made on the products of cyclone classification. These measurements showed that the underflow (platy talc) has a greater reflectance than the overflow (fine acicular talc). A third test made on flotation products demonstrated that purity of sample is also a factor, the float product producing a higher reading than the starting sample. The data related to shape and purity will be included in a report on the beneficiation of talc.

The Gardner Color Meter, among other applications, measures properties designated as Rd and +b. The Rd measurement is one of reflectivity in the sense of brightness, apart from color. The higher the Rd value obtained, the greater the brightness. The +b measurement is one of color based on yellowness, but corresponding to whiteness in near white materials. The lower the +b value the greater is the whiteness.

*Model 610, Photovolt Corporation, New York, New York.

**Gardner Instrument Company, Bethesda, Maryland. This is similar to the instrument used by Johnson and Johnson's Research Laboratory.

Measurements made on the Cranford samples showed a range of 91.30 to 93.25 for Rd and 1.55 to 1.95 for +b, with no correlation as yet established with other physical properties (Table 21).

To test if particle size has any effect on Rd and +b, measurements were made on a series of size fractions, showing that brightness increased in the finer fractions and that whiteness increased with fineness except for the minus 400-mesh fraction (Table 22). In order to interpret the aberrant figure the minus 400-mesh fraction will have to be subdivided and further +b values obtained. It is expected that the concentration of extremely fine acicular particles in the minus 400-mesh fraction accounts for the decrease in the +b measurement. It appears, since 1.60 is the value obtained on the whole powder, that whiteness is lower in the extreme particle sizes, both coarse and fine.

To test the effect of purity of sample on Rd and +b, measurements were made on beneficiated products, showing that the removal of contamination measurably improves Rd and +b. Measurements to be made on cyclone products will demonstrate the effect of particle shape on these properties. These studies will be presented in a forthcoming report on the beneficiation of talc.

Further work is recommended in the matter of improving the sheen of talc. Further investigation is required in the tracing of the specific properties of reflectance to specific particles prior to visualizing beneficiation for the improvement of sheen. It is hoped to be able to adapt a Glossmeter for use on powdered talc in order to be able to correlate properties and plan beneficiation for the improvement of specular reflectance. When sheen can conclusively be traced to specific physical properties of the powder, then beneficiation for its improvement can be visualized.

THE DUST COMPONENT

For the purpose of this report dust may be defined as that fraction of the talcum which remains air borne when the powder is shaken from its container. The dust may be collected for examination by passing a moistened glass slide through the dust cloud which remains suspended in the air when talc is shaken from a container, or by similarly sampling the suspended material after an open container is struck on the bottom onto a table or similar surface. Such action produces two classes of matter, a cloud comprising the bulk of the talc which quickly settles, and a fine portion which does not. Material so collected has been analyzed petrographically and has been found to be composed primarily of platy talc, essentially free of contaminants or acicular particles. This talc represents the finer sizes of platelets - the maximum diameter being about 15 μ in the larger particles. This roughly corresponds to the theoretical <5- μ sphere fraction⁽²⁾ not including any amount of nonplaty grains or coarser platelets.

The nature of the dust component has been established and it appears likely that it is amenable to beneficiation. Work is at present under way devising a means of comparatively measuring the dust component of talc samples, and to devise a means for its removal should it be practically separable from the whole powder.

TABLE 21. Rd, +b, AND LAR MEASUREMENTS ON THE CRANFORD SAMPLES

Sample Date	Rd	+b	LAR
12-22-56	93.25	1.75	97.5
9-12-56	93.15	1.80	97.0
8-10-56	93.00	1.90	97.0
10-18-56	92.55	1.75	97.5
11-15-56	92.45	1.75	97.0
9-6-56	92.35	1.75	95.0
8-28-56	92.20	1.65	96.0
9-19-56	92.15	1.55	96.0
9-27-56	92.10	1.60	97.0
8-20-56	92.05	1.90	95.5
11-30-56	91.80	1.75	96.0
11-6-56	91.75	1.75	96.0
10-29-56	91.55	1.55	97.5
10-12-56	91.35	1.60	96.0
10-4-56	91.30	1.95	96.0

TABLE 22. Rd, +b, AND LAR AS RELATED TO THE PARTICLE SIZE OF ITALIAN TALC

Tyler Mesh Size	Rd	+b	LAR
Unseparated	91.40	1.60	96.0
+200	85.60	1.90	91.0
-200+250	89.15	1.45	92.0
-250+270	90.36	1.35	92.5
-270+325	90.50	1.30	93.0
-325+400	91.50	1.20	96.0
-400	92.55	1.50	96.0

APPRAISAL OF PHYSICAL-PROPERTY MEASUREMENTS IN THE
EVALUATION OF ORES AND BENEFICIATION PRODUCTS

The foregoing studies, and those previously reported⁽¹⁾, have established the relationships between many of the physical properties of talc and subjective evaluation. Many of the devices employed were helpful in establishing the interrelationships of physical properties, have served their purpose, and their use is not requisite to evaluate the acceptability of talc, inasmuch as the interrelationship of properties permits such an evaluation to be made on the basis of a minimum of measurements.

The subjective tests do not measure specific properties and thus are only of comparative value in deciding what is the specific problem in a nonacceptable talc, or how it may be made acceptable by beneficiation. Such tests, however, must remain the final analysis of acceptability of beneficiation products or in the selection of natural high-grade talcs.

The subjective tests are both a matter of touch and visual comparison. Tested by touch, individual consideration may be given to slip and abrasiveness. Quickly noted in nonacceptable talcs or improper grinds of otherwise acceptable talcs are dry floury feelings, pastiness, the rolling of the powder, poor spread which leaves portions unlubricated, and coarse or sharp grit. Visually it may be quickly noted if the powder is colored or off-white, without sheen, spreads unevenly, contains coarse brilliant particles, or contains a high component of extremely fine dust.

To measure improvement in talc, to maintain quality control, or to visualize proper beneficiation for the improvement of a talc, it is necessary to measure specific physical properties of the powder as a whole, to know the size and shape of the talc particles, and the nature of the contaminants.

Following the subjective appraisal, of foremost importance is petrographic examination. Such a study establishes the platy or nonplaty nature of a talc, identifies the contaminants, and should establish the general size distribution, incidence, degree of subdivision, habit of aggregation, and crystallographic varieties, of the talc, carbonates, amphiboles, and accessory mineral components.

In order to beneficiate for the improvement of slip or the elimination of grit, it is necessary to know the size distribution not only of the crystallographic types of talc present, but also of the different impurities. Size-distribution procedures yield products which may be studied petrographically. These include screening, in the coarser fractions, and sedimentation in the fines. The measurements assigned sedimentation products in usual procedures should be checked petrographically inasmuch as talc platelets behave in the manner of theoretical spheres of much smaller dimensions. A practical method of comparing powders, so long as the theoretical measurements do not become mistaken for actual diameters, is the Andreason sedimentation technique, previously reported⁽²⁾. When this method is employed with supporting petrography it should be a satisfactory device for evaluating beneficiation products.

Without proper size and mineral knowledge of a sample of talc, beneficiation procedures cannot be developed. Control over the physical properties of a talc of known and fairly constant composition could be kept by the use of refinements of the experimental lubricity and abrasion-measuring devices. However, a knowledge of the mineralogy and size distribution is recommended for any talc.

The measurement of surface area, specific surface, porosity, and average diameter will be considered further in regard to compactibility and ullage, and the absorptive power of talc; however, these are not necessary to consider as prerequisite to beneficiation studies for the improvement of the physical properties of talc. The lubricity board and abrasion machine were built to measure small differences in heretofore purely subjective properties and to relate them to established physical measurements. With proper mineralogical and size-distribution knowledge, these properties will be reflected in the other physical measurements.

The following presents the measurements which should be attained in beneficiation products in order to produce material equivalent in quality to Italian No. 1 talc. Improvement of these properties will, of course, produce superior powder, when not improved at the expense of other physical properties. Beneficiation studies on Italian No. 2 talc have produced powder considerably superior to grade No. 1 Italian talc in slip, purity, and the absence of grit.

The following are the recommended requirements for beneficiation products to be the equivalent of Italian No. 1 talc. The items considered important at this stage of the investigation are marked with an asterisk.

Mineralogy*

Platy talc, 90 per cent or more
Nonplaty talc, less than 10 per cent
Carbonates, less than 2 to 3 per cent
Amphiboles, less than 1 per cent
Accessory minerals, trace only
Opaques, none.

Size Distribution*

- (1) Whole powder: Greater than 150 mesh, none
Greater than 200 mesh, less than 1 per cent
Greater than 325 mesh, less than 10 per cent
Greater than 400 mesh, less than 20 per cent.

The powder should have a size-distribution curve over its general range similar to that shown by Andreason sedimentation measurement⁽²⁾ of theoretical particles. Many of the particles finer than the theoretical 5- μ spheres are undesirable, representing fine acicular grains and dust. Fines, however, should not be removed to the extent that the bulk density is raised beyond present specifications.

- (2) Contaminants: Greater than 250 mesh, less than 1 per cent
-250 to +400 mesh, not more than 2 per cent
Finer than 400 mesh, less than 3 per cent.

Note: There is reason to believe that the grind of Italian No. 1 talc is finer than optimum for the production of a superior beneficiated talc. Possibly talc 100 per cent minus 100 mesh would be fine enough. The principal reason for a minus 200-mesh grind for the currently used product may be to reduce the grit to a size where the platelets mask it. With beneficiated talc this would not be necessary and there would be less fines to discard.

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Lubricity Measurement

Greater than 0.93 second, preferably greater than 1 second.

Porosity

Approximately 0.45 to 0.50.

Average Particle Diameter

Approximately 2.4 to 3.3 μ . This measurement is made on the Fisher Subsieve Sizer, the figures are of theoretical particles but are not to be compared with those from the Andreason measurements.

Bulk Density*

22 to 24 lb/cu. ft.

Specific Surface, Theoretical

Greater than 6600 cm^2/g , preferable measurements lie in the 8000- cm^2/g range.

Abrasion-Machine Measurement

Talc pellets - less than 2.7×10^{-3} in./sec, preferably less than 2×10^{-3} in./sec.

Carbonate pellets - less than 1×10^{-3} in./sec.

Moisture Content*

Less than 0.08 per cent, preferably 0.05 per cent or less.

pH

Less than 9.4, preferably closer to 7 in order to lower the expense of the acid additive.

Acid Solubility*

Gravimetric, less than 3 per cent
Volumetric, less than 2 per cent.

LAR

95.0 or greater.

Rd*

91.0 or greater.

+b* Less than 2.0. (An additional color measurement, -a, should be taken when talcs with a yellow-green tint are studied.)

The above measurements concern purity, slip, and grit, and the measurement of acceptability of beneficiation products. Yet to be reported on are preferred measurements on the Glossmeter, preferred limits of the dust component, absorptiveness, and compactibility. Although specific problems may arise when other than Italian talc is considered, the above measurements should generally suffice for most raw talcs in the measurement of improvement by beneficiation or of acceptability in regard to Johnson and Johnson's present requirements.

FUTURE WORK

Future work related to the physical properties of talc includes studies of the absorptive power to talc, measurements of gloss as distinct from whiteness and reflectance, measurements of compactibility, the dust component, studies on the effects of different methods of drying processed talc on its physical properties, and further evaluation of the physical properties and mineralogy of beneficiation products.

Because of immediate pressure on other phases of work for Johnson and Johnson most of the above studies will be held in abeyance.

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- (2) Macdonald, R. D. , letter report to Johnson and Johnson on the Andreason Sedimentation Procedure (April 1, 1958).
- (3) Smith, W. L. , and Snider, R. H. , "Investigation of the Salgada and Casa Nova Talc Deposits of Brazil", Battelle report to Johnson and Johnson (May 28, 1957).
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- (5) Brown, W. E. , letter report to Johnson and Johnson on the flotation amenability of Italian and other talcs (January 24, 1958).
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- (8) Brown, W. E. , Smith, W. L. , and Macdonald, R. D. , "The Physical Concentration of Talc Ores - Flotation", Battelle report to Johnson and Johnson (May 23, 1958).

The original notes on the laboratory work described in this report are in Battelle Laboratory Record Books No. 13034, pages 78 through 96; No. 14187, pages 44 through 100; No. 14431, pages 7 through 100; and No. 14677, pages 1 through 8. The work was done in the period from October 21, 1957, to May 5, 1958.

WLS:djo/gpi/bah

APPENDIX A

DESCRIPTION OF ABRASION MACHINE AND TECHNIQUE OF OPERATION

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APPENDIX A

DESCRIPTION OF ABRASION MACHINE AND TECHNIQUE OF OPERATION

The experimental device described as the abrasion machine in this report (Figures 1 and 2) consists of a 1/20-hp 220-volt 60-cycle 1725-rpm three-phase Westinghouse electric motor, mounted vertically at operating height, fitted with a steel lap. The steel lap has a diameter of 5 inches and is designed so a lap cloth may be held in place by a rubber belt. A Buehler Microcloth was selected as a standard lapcloth. The lap is housed in a steel bowl 5 inches deep and 9-1/2 inches in diameter. A spout extends from the bottom of the bowl to carry the tested slurry into a beaker. A plastic shield is fitted over the top of the bowl to prevent spatter. A hole in the shield permits observation of the operation and access to the sample holder and slurry feed tube.

The slurry feed tube and a cylindrical 1/2-inch-diameter sample holder are fitted into a metal strip which is fastened in place over the lap. The sample holder is fixed 2 inches from the center of the lap. Directly behind the sample holder the slurry feed tube is fixed in a similar position so that the clockwise rotation of the lap brings the slurry which is to be measured under the standard talc pellet. The talc test pellet is held onto the lap by a 16.1-gram weight which prevents the pellet from skipping or floating on the rotating lap. The slurry feed tube is connected by a rubber tube with an adjustable clamp to a separatory funnel held in a ringstand. The funnel is a 500-ml open-top separatory funnel equipped with a stopcock, and serves as the reservoir for the slurry which is to be measured. The time of operation is kept on a Kodak electric timer.

The pellets are made of minus 400-mesh Italian talc pressed in a F. S. Carver Laboratory Press under 50,000 psi. The pellets are 1/2 inch in diameter, and the 5.2-gram samples used make a pellet about 7/10 inch long.

In addition to the standard talc pellets used in the measurement of total abrasive particles, carbonate pellets were used to measure abrasion by the harder contaminants alone. The carbonate pellets were made by fusing three parts by weight of sodium carbonate to one part of sodium borate into a melt. The fused melt was then crushed and pressed similarly as the talc pellets, under 15,000 psi. Because of swelling during drying the carbonate pellets must be measured wet, unlike the talc pellets. Also, because of slight solubility, the slurry to be tested must be a mixture with alcohol instead of water. The carbonate pellets are less satisfactory than the talc pellets, however, they served a specific experimental purpose.

In operation, the slurry, composed of 3 grams of the talc to be measured, in 350 ml of distilled water, passes onto the rotating lap at a rate controlled by a clamp on the feed tube. The slurry is carried under the standard pellet where the abrasive components wear the pellet at a rate approximating abrasion of the pellet by some 1800 ft/min of surface composed of the sample slurry. Pure samples of talc were found to effect little abrasion, while contaminated talc was found to quickly wear away the pellet. The amount of abrasion loss as measured on a Starrett micrometer caliper is divided by the number of seconds of abrasion to provide figures representing the degree of abrasion.

Should similar experiments be repeated, the following are important considerations. In any series of tests the operation time of the machine should be essentially the same. The talc slurry should be kept in suspension by agitation. A new lap cloth should be used

A-2

as soon as any wear is noticed. All the talc pellets used in a series of tests should be pressed at the same time. Talc pellets should be dried overnight before measuring, to prevent any swelling effects of absorption of water. When any reruns are required on the abrasion machine, the slurry feed should be adjusted to reproduce former readings before comparative data are sought. To make proper comparative measurements the abrasion machine should be operating so as to make replicate tests showing a difference of not more than 0.1×10^{-3} in./sec of abrasion.

APPENDIX B

DETERMINATION OF EQUIVALENT DOLOMITE CONTENT
IN ITALIAN TALC BY VOLUMETRIC ANALYSIS

by

W. E. Brown

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Wage procedure:

5 gram sample + 500 cc 0.2 N HCl digest at 100°
for 45 min. heat to boiling, cool, add methyl
orange indicator.

titrate with 0.1 N NaOH

Calculation:

$(cc\ HCl \times N) - (cc\ NaOH \times N) = \text{millequivalents acid}$
millequivalents $\times .92 = \%$ dolomite
grams HCl $\times 1.54 = \%$ magnesite
grams HCl $\times 1.00 = \%$ carbonate in sample.

5 gram or millequivalents $\times .92 = \%$ carbonate in sample
5 " " $\times 1.54 =$ " "
5 gram or " $\times .84 = \%$ magnesite

as Magnesite

$$\frac{\text{grams HCl} \times 1.15 \times 100}{5} = \% \text{ carbs.}$$

For
5 grams

millequivalents $\times .92 = \% \text{ dolomite}$
" $\times .84 = \% \text{ magnesite}$
" $\times 1.00 = \% \text{ calcite}$

as magnesite using 2 gram sample.

$M_2 \times 21 = \% \text{ carbonates}$

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APPENDIX B

DETERMINATION OF EQUIVALENT DOLOMITE CONTENT
IN ITALIAN TALC BY VOLUMETRIC ANALYSIS

by

W. E. Brown

- (1) Prepare a solution of approximately 0. 2N sodium hydroxide and determine exact normality.
- (2) Prepare a solution of approximately 0. 2N hydrochloric acid and determine exact normality.
- (3) Weigh out for analysis a 5.000-gram sample of talc and put in a 250-cc beaker.
- (4) Add ⁵⁵25 ml of distilled water to the talc sample and stir with a glass rod to thoroughly wet the talc.
- (5) Add 50 cc of the HCl solution prepared in Step (2). 20 cc
- (6) Heat sample, containing water and HCl, for 45 minutes at 105 C.
- (7) Raise temperature to boiling for approximately 1/2 minute to expel H₂CO₃. Use care so that the sample does not boil over.
- (8) Cool to room temperature.
- (9) Add 4 drops of methyl orange indicator to the cooled sample and stir.
- (10) Titrate the sample with the NaOH [from Step (1)] to a yellow end point. This determines the amount of unused acid.
- (11) Calculate the per cent dolomite. An example of the calculations is as follows:

Given: Normality of NaOH = 0. 2055 [from Step (1)]

Normality of HCl = 0. 2120 [from Step (2)]

Each milliliter of HCl contains $\frac{36.5}{100} \times 0. 2120 = 0. 0077$ gram of pure HCl

1 ml of NaOH neutralizes 0. 97 ml of HCl

1 gram of HCl neutralizes 1. 26 grams of dolomite

47. 6 ml of NaOH was required to titrate a 5-gram sample which had been digested with 50 ml of HCl.

1.26 dolomite
1.15 magnesite
1.37 calcite

B-2

$47.6 \times 0.97 = 46.17$ ml of unused HCl
 $50.00 - 46.17 = 3.83$ ml HCl consumed by dolomite
 $3.83 \times 0.0077 = 0.0295$ gram HCl consumed by dolomite
 $0.0295 \times 1.26 = 0.0372$ gram dolomite dissolved by HCl
 $\frac{0.0372}{5.000} \times 100 = 0.74$ per cent dolomite.

Note: In order to test the accuracy of this method of analysis, some relatively pure dolomite (taken from a mineral specimen) was analyzed. The weight of the sample analyzed was 0.0300 gram. The foregoing analytical method showed the sample to contain 0.0306 gram of dolomite. Another check test was made by analyzing a sample of Italian talc for per cent of CO_2 , and converting the CO_2 content to the theoretical amount in dolomite. The CO_2 analysis indicated that the dolomite content was 2.26 per cent. By volumetric analysis the dolomite content was calculated to be 2.18 per cent.

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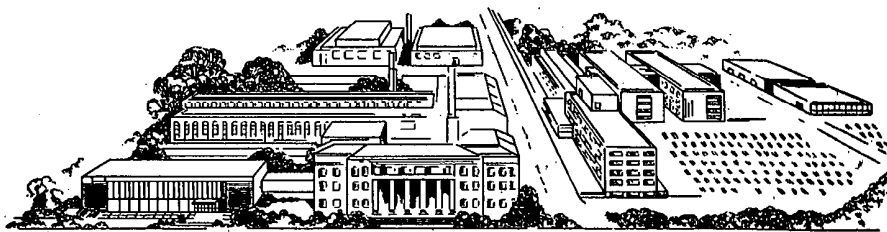
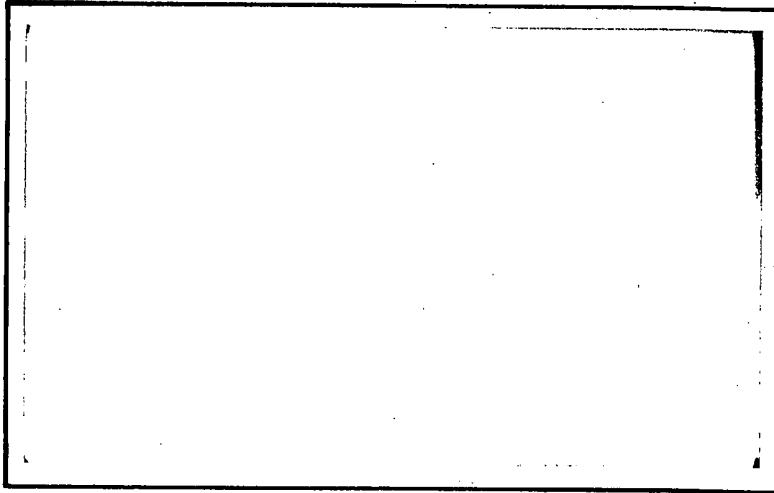
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Exhibit 45

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RESEARCH REPORT



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BIOCHEMISTRY	METALLURGICAL PROCESSES
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ELECTROCHEMISTRY	PHARMACEUTICAL CHEMISTRY
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ELECTRONICS	PULP AND PAPER TECHNOLOGY
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INORGANIC CHEMISTRY	WOOD AND FOREST PRODUCTS

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PHASE REPORT

on

PILOT-PLANT BENEFICIATION OF ITALIAN
RUN-OF-MINE TALC

to

JOHNSON AND JOHNSON

March 8, 1960

by

R. W. Schatz

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio

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5 0 5 K I N G A V E N U E C O L U M B U S I , O H I O

March 28, 1960

Mr. W. H. Ashton
Johnson and Johnson
Research Department
New Brunswick, New Jersey

Dear Mr. Ashton:

We are pleased to transmit six copies of our Phase Report, "Pilot-Plant Beneficiation of Italian Run-of-Mine Talc".

As pointed out in the report, the runs were quite successful in that a superior talc product of high luster and platiness was obtained at a high recovery.

Sincerely yours,


O. F. Tangel

OFT/mln
Enc. (6)

cc: Dr. W. H. Lycan
Mr. C. V. Swank

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PHASE REPORT

on

PILOT-PLANT BENEFICIATION OF ITALIAN RUN-OF-MINE TALC

to

JOHNSON AND JOHNSON

from

BATTELLE MEMORIAL INSTITUTE

by

R. W. Schatz

March 8, 1960

INTRODUCTION AND SUMMARY

Laboratory work* had shown that a superior talc product could be produced by wet grinding and flotation of Italian run-of-mine** talc. Consequently, Italian run-of-mine talc was processed in the pilot plant to demonstrate the technical feasibility of the process and to obtain drum quantities for panel testing.

The treatment procedure was as follows: after hammermill crushing to minus 1/4 inch, the talc was ground wet in a pebble mill, in closed circuit with cyclones, to approximately 98 per cent minus 200 mesh. After removal of the major portion of the minus 10-micron fraction in other cyclones, the platy talc was recovered by flotation, filtered, and spray dried. Sixty to sixty-five per cent by weight of the feed to the plant was recovered as a superior talc product. Deionized water was used throughout the process.

The beneficiated talc was at least 99 per cent platy, analyzed from 0.2 to 0.3 per cent CO₂, contained about 12 to 13 per cent of minus 10-micron material, and had a luster higher than either the presently sold baby powder or the beneficiated Italian No. 2 talc.

* Progress Report, "The Physical Concentration of Talc Ores-Flotation of Italian Run-of-Mine Talc", December 31, 1959.

** Hereafter abbreviated as ROM.

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SCOPE OF THE PILOT-PLANT WORK

The pilot-plant study of the beneficiation of Italian ROM talc was composed essentially of two phases. The first was to determine the operating conditions required in the grinding circuit to produce a suitable wet-ground talc for flotation. The second was to establish flotation conditions for the beneficiation of the wet-ground talc. The first phase was completed in the last half of September and the first half of October, 1959. The flotation phase was completed by the middle of November, 1959.

GRINDING INVESTIGATION

The grind desired on the Italian ROM talc was 98 per cent minus 200 mesh with a minimum of minus 10-micron material. Equipment in the crushing and grinding circuit included a hammermill (4)*, pebble mill (8), two cyclones (10, 10a) together with the necessary pumps (9, 9a), conveying (3-5), storage (6), and feeding (7) facilities. A feed rate of about 450 pounds per hour to the grinding circuit was desired because this rate was the approximate capacity of the beneficiation section of the pilot plant.

Crushing

The ROM talc was received in burlap sacks (150 pounds per sack) and had been crushed to about minus 2 inches. In order to maintain a fixed storage bin level, three sacks of talc were crushed per hour; two on the hour, one on the half hour. The hammermill product was nominally minus 1/4 inch in size. Table 1 presents typical screen analyses of the ROM talc before and after hammermill crushing.

Grinding

The following general plan was used to determine the operating conditions required for the desired grind. For each set of conditions the circuit was first operated for about 4 hours to establish equilibrium. After equilibrium had been reached, as determined by pulp density and volume measurements throughout the circuit, the required samples were taken over a period of 2 to 3 hours. Based on the analyses of these samples, changes were made in the operating conditions, and after equilibrium was reached, the circuit was again sampled. This procedure was repeated until the desired operating conditions were established.

* For equipment specifications see corresponding identification number in the Phase Report "Design and Construction of a Talc Flotation Pilot Plant", December 30, 1959.

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The initial tests, started on September 18, 1959, were made using the pebble mill (8) with 1500 pounds of 1-1/4-inch porcelain balls and the 4-inch (No. 1) short cyclone (10). It was soon apparent that insufficient grinding was being obtained in the mill, and, therefore, the pebble load was increased to 2900 pounds. Additional runs were made using the one cyclone with various apex (discharge) openings, feed and overflow discharge pressures, and pulp densities. The finest grind reached was 90 per cent minus 200 mesh with about a 20 per cent minus 10 microns.

It appeared that, to reach the desired grind, it would be necessary to use No. 1 and No. 2 cyclones in series, i. e., the second cyclone retreating the overflow from the first, with the underflow from both cyclones returning to the pebble mill. After considerable experimentation with this circuit, operating conditions were established which gave a grind of 98 per cent minus 200 mesh with 25 to 30 per cent minus 10 microns. This grinding investigation was completed on October 15, 1959.

Figure 1 shows the flowsheet of the grinding circuit. Typical operating data, as well as an approximate water-solids balance also are shown.

Table 1 gives typical screen size analyses for the various points in the grinding circuit. Tables 2 and 3 present additional operating data: volumes, pump densities, water requirements, cyclone operating pressures, and efficiency calculations.

The circulating load and classification efficiencies of Table 3 are worthy of comment. The circulating load of 660 per cent is rather high for a conventional ball mill-cyclone circuit. In addition, the classification efficiency of 21 per cent (based on recovery of minus 200-mesh material fed to the cyclone circuit) is low.

At least two factors contribute to these conditions. One is the platy character of talc. As particle shape deviates from a sphere or cube, classification becomes more difficult, and in a one-pass operation more inefficient. In addition, a 98 per cent minus 200-mesh grind with less than 0.3 per cent on 100 mesh is a difficult grind to reach, particularly with a platy material. Excellent rejection of the plus 200-mesh fraction must be obtained, and this is only accomplished at the expense of recirculating a considerable quantity of finished (minus 200 mesh) product to the pebble mill. The efficiency of rejection of plus 200-mesh material was excellent: 99 per cent, as shown in Table 3.

Further experimentation with the grinding circuit might lead to a grind of 98 per cent minus 200 mesh with less than 25 to 30 per cent of 10-micron material, as well as lower circulating loads and improved efficiencies. For an investigation of this sort, 24-hour (continuous) operation would be necessary with minor changes in the circuit from time to time. This type of an investigation is one that is best made in an operating plant because the effect of each minor change will be small and a number of days of operation under each set of conditions are necessary to establish the effect of the change. It is Battelle's opinion that improvements in the grind can be made which will reduce the quantity of minus 10-micron talc.

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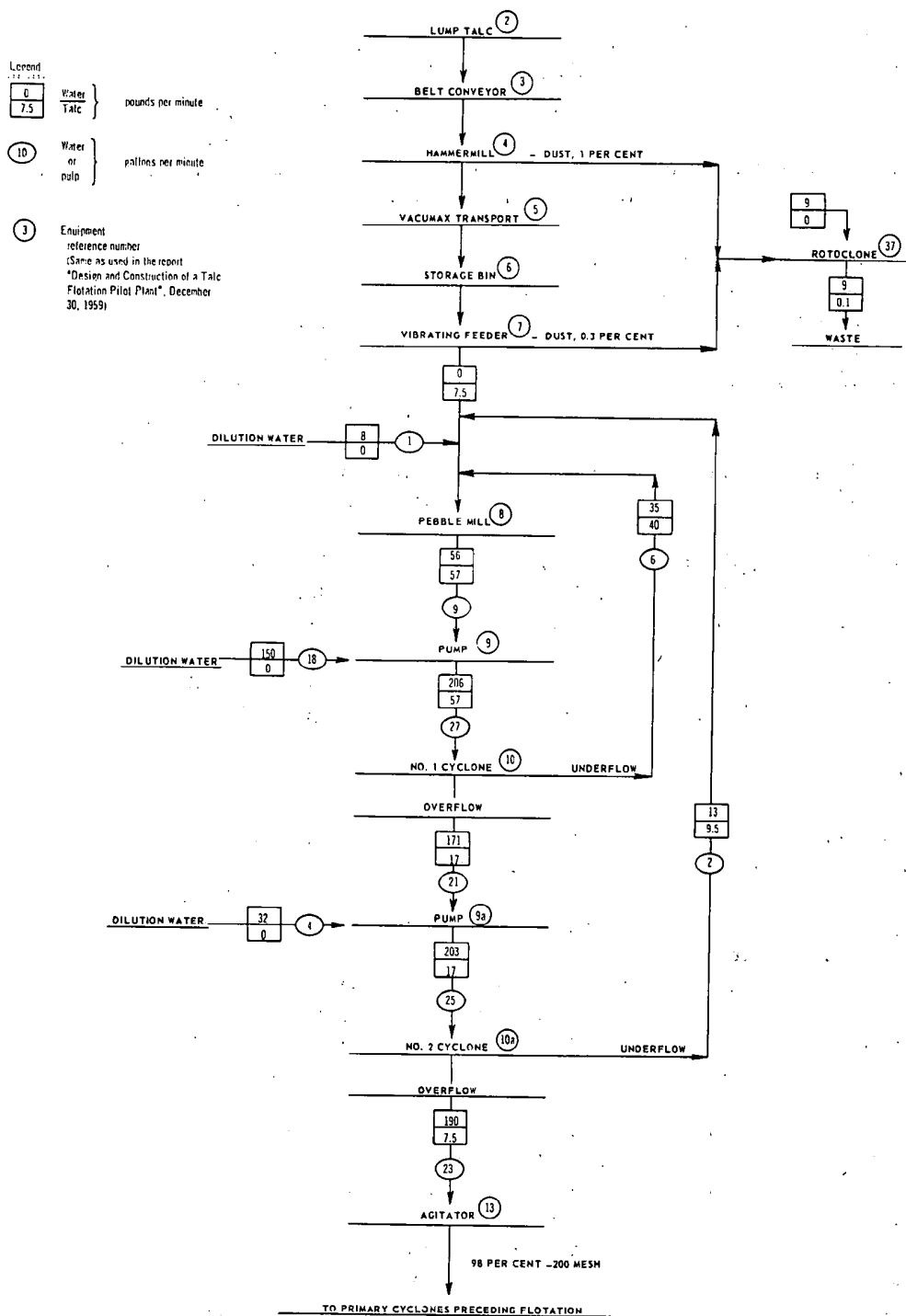


FIGURE 1. PILOT-PLANT GRINDING CIRCUIT FLOWSHEET FOR TREATMENT OF ITALIAN RUN-OF-MINE TALC

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TABLE 1. TYPICAL SIZE-DISTRIBUTION DATA, CRUSHING AND GRINDING CIRCUIT^(a)

Pilot-Plant Treatment of Italian Run-of-Mine Talc

Mesh	Size Distribution, per cent by weight						
	Hammermill		Ball-Mill Discharge	No. 1 Cyclone		No. 2 Cyclone	
	Feed ^(b)	Product ^(c)		U'flow	O'flow	U'flow	O'flow ^(d)
+ 3	41.8	--	--	--	--	--	--
- 3+ 10	22.7	12.0	tr	tr	--	--	--
- 10+ 20	11.7	15.3	0.4	0.4	--	tr	--
- 20+ 35	5.8	17.3	1.7	2.5	--	tr	--
- 35+ 65	6.6	16.8	8.3	10.9	5.0	0.5	tr
- 65+100	2.9	6.5	14.5	16.3	3.2	3.2	tr
-100+200	3.2	6.1	14.2	14.5	2.2	10.4	2.0
-200	5.3	26.0	60.9	55.4	89.6	85.9	98.0
- 10 microns	0.3	1.0	6.8	--	--	--	29.6

(a) Run of October 22, 1959.

(b) All passing 2 inch.

(c) Ball-mill feed.

(d) Feed to primary cyclones preceding flotation.

TABLE 2. TYPICAL GRINDING-CIRCUIT OPERATING DATA

Pilot-Plant Treatment of Italian Run-of-Mine Talc

Circuit	Weights, Volumes, and Pulp Densities			
	Solids, lb/min	Slurry		New Water, gpm
		Solids, %	GPM	
Pebble Mill				
New Feed (dry)	7.5	--		1
Discharge	--	51	9	--
No. 1 Cyclone				
Feed	57	22	27	18
Overflow	17	9	21	--
Underflow	40	53	6	--
No. 2 Cyclone				
Feed	17	8	25	4
Overflow	7.5	4	23	--
Underflow	9.5	42	2	--

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TABLE 3. TYPICAL GRINDING-CIRCUIT OPERATING DATA

Pilot-Plant Treatment of Italian Run-of-Mine Talc

Grinding-Circuit Circulating Load

Per cent circulating load = $\frac{\text{Weight cyclone underflow}}{\text{Weight new feed}} \times 100$

New feed = 7.5 lb/min

Underflow, No. 1 cyclone = 40 lb/min

Underflow, No. 2 cyclone = 9.5 lb/min

Per cent circulating load = $\frac{40 + 9.5}{7.5} \times 100 = 660\%$

Grinding-Circuit Classification Efficiency
(At 200 Mesh)

Recovery of Minus 200-Mesh Fraction

Efficiency, % = $\frac{\text{Weight of minus 200-mesh No. 2 cyclone overflow}}{\text{Weight of minus 200-mesh No. 1 cyclone feed}} \times 100$

Efficiency, % = $\frac{7.5 \times 0.98}{0.57 \times 0.609} \times 100 = 21.2\%$

Rejection of Plus 200-Mesh Fraction

Efficiency, % =

$$\frac{\text{Weight of plus 200-mesh No. 1 cyclone feed) - (Weight of plus 200-mesh No. 2 cyclone overflow)}}{\text{Weight of plus 200-mesh No. 1 cyclone feed}} \times 100$$

Efficiency, % = $\frac{(57 \times 0.391) - (7.5 \times 0.02)}{57 \times 0.391} \times 100 = 99.3\%$

Cyclone Operating Data

	Pressure, psig			
	<u>Gpm Feed</u>	<u>Feed</u>	<u>Overflow</u>	<u>Underflow</u>
No. 1 Cyclone(a)	27	22	2	(c)
No. 2 Cyclone(b)	25	16	6	(c)

(a) 4-inch short cyclone - 9/16-inch inlet
1-inch vortex finder
3/4-inch apex.

(b) 4-inch long cyclone - 3/4-inch inlet
3/4-inch vortex finder
3/8-inch apex.

(c) Free discharge.

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BENEFICIATION

Beneficiation of the wet-ground ROM talc was started on October 19, 1959. The first circuit used was that employed in the concentration of Italian No. 2 talc.*

Microscopic examination of the froth from each cell showed that the talc being floated in all of the first 6 flotation cells was of good quality and that recirculation of the concentrate from Cells 5 and 6 (as practiced on Italian No. 2) was not necessary. Consequently, circuit changes were made which eliminated Float 2, the scavenger cyclones, and the scavenger flotation cells. Thus all 6 cells of the previous Float 1 and Float 2 circuits became Float 1.

After several hours of operation with this straight rougher (Float 1) circuit on October 21, it was apparent that insufficient quantities of flotation reagents were being used. (This was because there was now no circulating load to return reagents to the flotation circuit.) Additional amounts of reagents were added for the balance of the shift. The low weight recovery, 49 per cent, obtained on this day is believed to be the result of several hours of operation with insufficient reagents.

This circuit, as shown in Figure 2, was operated on October 22, November 3, and November 4 with no changes. On November 5 and 6 reagents were increased 10 per cent. The metallurgical results obtained during these 6 days of operation are given in Table 4. Recoveries of 60 to 65 per cent, based on plant feed, were obtained in producing a superior talc product.

Typical operating data are given in Figure 2 and Tables 5, 6, and 7. These include size analyses, weights, volumes, pulp densities, cyclone operating data, primary cyclone efficiency calculations, and flotation reagent quantities.

OPERATIONAL PROBLEMS

The usual start-up and break-in problems were encountered in the grinding circuit, but once these had been solved, the entire circuit ran smoothly. Minor problems that occurred, and should be kept in mind in designing a commercial plant, have been discussed in the Phase Report of December 30, 1959, "Design and Construction of a Talc Flotation Pilot Plant".

* Phase Report, "Pilot-Plant Beneficiation of Italian No. 2 Talc", March 1, 1960.

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TABLE 4. SUMMARY OF PILOT-PLANT BENEFICIATION OF ITALIAN
RUN-OF-MINE TALC

Date, 1959	Oct. 21	Oct. 22	Nov. 3	Nov. 4	Nov. 5	Nov. 6
Feed Rate, lb/hr	438	432	467	440	442	468
Operating Time, min	359	380	366	390	390	330
Feed(a)						
Platy Talc, %	91-92	91-92	91-92	91-92	91-92	91-92
CO ₂ , %	0.61	0.64	0.68	0.61	0.68	0.61
-10 Micron, %	29.5	29.6	27.0	25.2	28.9	26.2
Beneficiated Talc						
Platy Talc, %	99	99	99	99	99	99
CO ₂ , %	0.15	0.17	0.26	0.19	0.32	0.28
-10 Micron, %	9.0	10.4	13.0	13.6	13.0	12.4
Over-All Weight Recovery, % ^(b)	48.8	58.0	61.8	61.1	61.3	65.9
Luster	nd	nd	1.59	1.56	1.54	1.59
Combined Tailings ^(c)						
CO ₂ , %	1.05	1.29	1.36	1.27	1.25	1.25
-10 Micron, %	61.9	59.0	nd	nd	nd	nd

(a) Grinding-circuit cyclone overflow.

(b) Based on CO₂ analyses.

(c) Primary cyclone combined with flotation tailing.

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TABLE 5. TYPICAL SIZE-DISTRIBUTION DATA, FLOTATION CIRCUIT(a)

Pilot-Plant Treatment of Italian Run-of-Mine Talc

Mesh	Primary Cyclones		Flotation Tailing	Combined Tailings(c)	Dryer Product
	U'flow(b)	O'flow			
+ 65	1.0	--	--	--	0.2
- 65+100	1.6	--	--	--	1.3
-100+200	0.6	--	--	--	1.0
-200	96.8	--	97.9	98.7	97.5
- 10 microns	9.4	71.2	15.4	59.0	10.4

(a) Run of October 22, 1959.

(b) Flotation feed.

(c) Flotation tailing combined with primary cyclone overflow.

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TABLE 6. TYPICAL PRIMARY-CYCLONE AND FLOTATION-CIRCUIT OPERATING DATA

Pilot-Plant Treatment of Italian Run-of-Mine Talc

Circuit	Weights, Volumes, and Pulp Densities			
	Solids, lb/min	Slurry		New Water, gpm
		Solids, %	GPM	
Primary Cyclones				
Feed	7.5	4	23	--
Overflow	2.25	1.4	20	--
Underflow(a)	5.25	7	9	6
Flotation				
Feed	5.25	7	9	--
Froth(b)	4.5	15	3	2
Tailing	0.75	1.3	8	--
Filtration				
Feed	4.5	15	3	1(c)
Filtrate	0	0	3.6	--
Cake	4.5	60	0.4	--
By-Product Thickener				
Feed	3.0	1.3	28	--
Overflow	0.18	--	27	--
Underflow	2.82	26	1	--

Primary Cyclone Classification Efficiency
(At 10 microns)

Rejection of Minus 10-Micron Fraction

$$\text{Efficiency, \%} = \frac{\text{Weight of minus 10 microns in cyclone overflow}}{\text{Weight of minus 10 microns in cyclone feed}} \times 100$$

$$\text{Efficiency, \%} = \frac{2.25 \times 0.712}{7.5 \times .296} \times 100 = 72.1\%$$

Cyclone Operating Data

	Pressure, psig			
	GPM	Feed	Overflow	Underflow
Primary Cyclones	23	32	10.5	6.5

(a) After dilution water.

(b) After launder spray water.

(c) Wash water on filter.

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TABLE 7. TYPICAL FLOTATION-REAGENT DATA

Pilot-Plant Treatment of Italian Run-of-Mine Talc

Reagent	Flotation Reagents, pounds per ton new feed								Total
	Conditioner	Flotation Cells						By-Product Thickener	
		1	2	3	4	5	6		
HCl, 37 %(a)	±1.0(e)								±1.0(e)
Dowfroth 250(b)	0.06	--	--	0.06	0.06	0.03	--		0.21
Aerosol 18(c)	0.24	--	0.24	--	0.12	--	--		0.60
Separan AP30(d)	--	--	--	--	--	--	--	0.10	0.10

(a) 10 % solution.

(b) 0.5 % solution.

(c) 2 % solution.

(d) 0.2 % solution.

(e) To pH 6.9-7.1.

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TABLE 8. CHARACTERISTICS OF TALC PRODUCTS

	Code	Petrographic Analysis, per cent(a)					CO ₂ , % ^(b)	Wt % -10 μ	Luster
		Platy Talc	Nonplaty Talc	Carbonate	Tremolite				
ROM talc, untreated	--	91-92	5	1-2	1		0.6-0.7		
Beneficiated ROM talc	ST94-95	>99	<1	<1	tr		0.22-0.24	11.3	157-153
Primary cyclone overflow	BP4	25	77	2-3	\pm 1		0.70	70.0	nd
Flotation tailing	BP5	83-85	6-8	7-9	1-2		2.68	14.0	nd
Combined by-products(c)	BP6	73	23	2-3	1-2		1.44	55.2	nd
Johnson and Johnson shelf product(d)		89	9	<2	tr		0.55	25-30	1.34
Italian No. 2 beneficiated	ST27-28	99	<1	<1	tr		0.33	8.7	1.47

(a) Determined by mineral count.

(b) Chemical analysis.

(c) Primary cyclone overflow combined with flotation tailing.

(d) Sample of August, 1958.

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CHARACTERISTICS OF PILOT-PLANT PRODUCTS

Table 8 lists the characteristics of the various talc products. The beneficiated talc was made on November 6 while the by-products were obtained on November 3 and 4. For comparison purposes, similar data are presented for the beneficiated talc from Italian No. 2 and the present Johnson and Johnson shelf product.

The outstanding property of the superior talc from ROM as compared with the Italian No. 2 concentrate is the appearance of the ROM talc. It is flakier and of higher luster. The higher luster apparent by eye also is confirmed by the luster measurements. The average luster for the superior talc over the period November 3 to 6 on ROM was 1.57; whereas for Italian No. 2 for the period August 13 to 21, it was 1.47.

SAMPLES SHIPPED TO JOHNSON AND JOHNSON

Approximately 360 pounds of superior talc produced on November 6 and three 15-pound samples of by-products (primary cyclone overflow, flotation tailings, and combined tailings) obtained on November 3 and 4 were shipped to Johnson and Johnson on November 25 and 27. Data on these samples are given in Table 8.

CONCLUSIONS AND FUTURE WORK

The pilot-plant beneficiation of ROM talc was completely successful in that a superior product representing about 60 to 65 per cent of the feed was obtained with little difficulty. Improvement in quality of product (particularly in regard to lowering the 10-micron content) probably cannot be expected by altering the flotation conditions without a sacrifice in recovery. On the other hand, increased recovery might be obtained by recycloning the primary cyclone overflow to recover some of the platy talc that it contains. Improvements in the grinding circuit to lessen production of 10-micron material would also increase recovery. Either or both of these improvements should not lower the quality of the beneficiated talc. From an operational cost standpoint, use of raw water or re-use of process water would appear to be the best areas for future investigations.

The original data for this report are to be found in Notebook No. 16330, pages 1 to 45. The work period covered is from September 14 through December 1, 1959.

RWS/mln

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JNJ000086877

Metadata

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Exhibit 46

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5 0 5 K I N G A V E N U E C O L U M B U S I , O H I O

June 6, 1961

Mr. W. H. Ashton
Research Department
Johnson and Johnson
New Brunswick, New Jersey

Dear Mr. Ashton:

This letter briefly summarizes my observations made during May at the Wight Mine, Gouverneur, N. Y.; the Hammondsville, Vt., deposit; and subsequent petrographic examinations of the ores and beneficiation products. The following covers only such information as I believe is of immediate consequence to you. A detailed geological and mineralogical report will follow if you so request.

THE GOUVERNEUR, N. Y., DEPOSIT

Talc deposits in the Gouverneur belt constitute the largest in the Western Hemisphere. In most of the Gouverneur deposits talc is subordinate. The ore is tremolite-anthophyllite schist which has been serpentized and steatized. The ore contains tremolite, anthophyllite, talc, serpentine, hexagonite, quartz, carbonates, micas, pyroxenes, and opaques. The talc belt is some six miles long, extends down dip over 2000 feet, and has widths over 400 feet. The particular talc of interest to Johnson & Johnson is a tremolitic platy talc in the Wight Mine. This facies is objectionable in the International Talc Company product and is avoided in mining. The body is 12 to 14 feet thick, extends from near surface through the 6th level and is presumed continuous along the strike of the ore. Although no attempt has been made to block out the platy ore, I was able to see a probable 100,000 tons, 300,000 tons can be estimated from drilling data and intersections of the present workings. Based on information provided by the International Talc Co., the reserves may be in excess of 1/2 million tons. The tonnage figures are only rough estimates. The ore reserves and the uniformity of the ore would have to be proven by drilling.

Flotation Concentrate from Gouverneur Talc

The ore contains both tremolite and platy talc as major components. The flotation concentrates you submitted contained:

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Mr. Ashton

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June 6, 1961

Total talc	96-97% (by count)
Platy talc	93
Nonplaty talc	3
Free tremolite, others	3-4

However, the talc platelets contain abundant fine tremolite which is liberated on successive fine grinding. Although the beneficiated talc is of high quality, it would appear that 4 or 5 per cent tremolite is the minimum which would be practically obtainable without extensive changes in the proposed beneficiation procedure.

THE HAMMONDSVILLE, VT., DEPOSIT

The ore previously mined at the Hammondsville deposit was off-color, highly contaminated, and unsuitable for producing high-grade talcum. When the old talc body was exhausted, mining proceeded underground and struck a white platy talc, so far unique in Vermont. The character of the new ore was reportedly not recognized until some two months ago. The ore is enclosed in quartz-mica schist, consists of some 70-75 per cent platy talc with inclusions of coarse carbonate grit (about 25 per cent) and accessory minerals.

The white, platy ore has not been blocked out, however, about 100,000 tons can be visualized from the present workings. If the talc body is as large as visualized by the Eastern Magnesia Talc Co., there may be as much as 1/2 million tons or more. The tonnage figures are only rough estimates. The ore reserves and the uniformity of the ore would have to be proven by drilling.

Flotation Concentrate from the Hammondsville Ore

Samples of the Hammondsville ore were processed by flotation by the Eastern Magnesia Talc Co. The flotation concentrate contained:

Total talc	97-98% (by count)
Platy talc	96
Nonplaty talc	<2
Carbonates	<1
Rutile (liberated)	<1
Altered amphiboles	trace
Opakes	trace
Others	<1

Examination of several specimens from different parts of the mine shows most of the ore to be free of rutile. Some specimens show 4-5 per cent rutile. On insufficient evidence the rutile appears to be traceable, for the most part, to a specific stope on the footwall.

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Mr. Ashton

-3-

June 6, 1961

EVALUATION

There are now two known domestic sources of talc ore which may be beneficiated to high-grade talcum and which appear to have adequate reserves. The flotation concentrates produced from the platy Gouverneur ore and the new Hammondsville ore have very good slip, color, and are primarily composed of single crystalline sheets.

Before a final conclusion is reached, the following should be considered:

- (1) The reserves of either mine should be blocked out and core drilled to establish uniformity.
- (2) It should be established whether or not the tremolite content of the Gouverneur concentrate, if prohibitive, can be removed economically by further beneficiation.
- (3) It should be established how the rutile is distributed throughout the Hammondsville deposit.
- (4) The Chester, Vermont, area should be surface-explored to determine if other similar deposits occur. The Carleton Quarry and the Vermont Talc Company quarry should be examined.

RECOMMENDATIONS

Excluding the matters of reserves and economics, the Hammondsville deposit appears preferable mineralogically inasmuch as the talc platelets are flatter and more equidimensional, and rutile and carbonate are known to be removable by beneficiation. Tremolite, which is present in the Gouverneur product, is a decidedly objectionable needle-like particle.

Very truly yours,



William Lee Smith
Principal Geologist

WLS:cw

Triplicate

cc: Dr. W. H. Lycan
Mr. J. N. Masci
Mr. C. V. Swank

Exhibit 47

Battelle Memorial Institute

S O S K I N G A V E N U E C O L U M B U S I , O H I O

August 25, 1961

Mr. W. H. Ashton
Research Department
Johnson and Johnson
New Brunswick, New Jersey

Dear Mr. Ashton:

The following constitutes an evaluation of the exploration work done to date on the Hammondsville talc deposit.

Surface holes 1, 2, 3, and 4 indicate the probable reserves of talc to be in excess of one-half million tons of ore, and the possible reserves to be greater.

The cores from holes 1 and 2 were examined and discussed with Mr. P. Bleser. They show the following:

	<u>Hole 1, feet</u>	<u>Hole 2, feet</u>
Overburden	0- 14	0- 2
Schist	14-104	2-165
Talc	104-120	165-169
"Cinder"	120-125	169-179
Talc	125-127	179-200
Schist	127-150	200-212

The talc body appears to thin down-dip from the mine. The talc from hole 1 is slightly darker than current production due to more abundant opaques and greenish gangue components. However, the talc is superior to the off color "unsatisfactory" ore previously obtained from the corresponding part of the mine. The major section of ore from hole 2 is about current grade. Ore from these thinner parts of the ore body will necessarily have a higher percentage of dilution by wall rock and border phase ore than that from the thicker parts of the ore body, unless the ore is selectively mined.

The drilling of hole 3 was observed. The core showed the following:

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Mr. W. H. Ashton

-2-

August 25, 1961

	<u>Hole 3, feet</u>
Overburden	0- 18
Schist	18-245
Talc (only 2' recovered)	245-249
Schist	249- —

The ore pinches in hole 3 in a position roughly down-dip from a similar pinching in the mine. Whether this thinning represents a continuation of that constriction of the ore seen in the mine, or a pinching-out down-dip, would have to be determined by further exploration. The ore from the center part of the talc section is of good grade; however, due to the poor recovery a composite sample shows a disproportionately high mica and amphibole contamination.

Hole 4 was selected during my recent visit. The results of the drilling were reported to me by Mr. V. Backels, as follows: talc from 147 to 193 feet, and from 203 to 265 feet, none to bottom at 273 feet. This is a total of 108 feet of talc. Eastern Magnesia will send to me specimens from the upper and lower talc zones for petrographic examination. The two zones were reported to have minor textural differences. The ore is reported to be high-grade white talc. Whether or not the platy character of the ore has been maintained in the thickened body is yet to be determined.

Generally speaking, the mineral purity and whiteness would be expected to be maintained or improved along the apparent strike of the ore toward the thicker section, and possibly to decrease down-dip from the mine. The character of the ore at the present heading and in hole 4 is of greater significance to the mineral nature of the deposit as a whole than is the character of the ore in holes 1, 2, and 3. A critical fact is whether or not the platy character of the talc is maintained throughout the greatly thickened section of the ore body.

Specific differences between the ore in the first three holes are not significant since proper sampling of the cores will not be possible until they are split, crushed, and composites are made for experimental work. Grain counts of the typical ore in cores 1, 2, and 3 showed the following range of composition:

Platy talc	60-65%
Nonplaty talc	1-4
Carbonates	30-35
Altered amphiboles	tr-1
Opagues (including pyrite)	tr->2
Chloritized silicates	<1->1
Micas	tr-1
Quartz, feldspar	tr
Rutile, fluorite, zircon, magnetite	0

Ore from hole 4 has not yet been examined.

Battelle Memorial Institute

Mr. W. H. Ashton

-3-

August 25, 1961

A sample of selected talc ore was high-graded from the pile near the roadside. This sample represents current ore without wall rock dilution and should correspond to selectively mined ore. The previous sample which was sent to Denver contained abundant gangue, more closely representing run-of-mine ore. The new sample was taken for comparative purposes, for possible work by Denver Equipment and Mr. Perkins. I have recommended to Mr. W. Magnus that Mr. Perkins repeat his initial beneficiation procedure (in which he obtained a product with a brightness of 84) on this newly obtained selected ore. The new sample of ore will also give Denver a chance to show what they can do with selectively mined ore.

The crystallographic habit of the talc in hole 4 and subsequent holes has yet to be determined. If the ore is uniform, the matter of reserves is no longer a problem. Inasmuch as the mine was flooded during my last visit to Hammondsville, it was impossible to sample the ore for rutile or to sample the current heading and shaft, as had been proposed. It is advisable that I take care of these details when I go to Vermont to study the subsequent cores, the composite sample, and the flotation products. A primary remaining problem is improving the color of the flotation product.

Very truly yours,

Bill

Wm. L. Smith
Principal Geologist

WLS:lb

Exhibit 48

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE

P.O. Box 112

GOLDEN, COLORADO 80401

April 14, 1971

CSMRI Project No. 200534 ✓

Mr. Robert Russell
Johnson & Johnson
Research Division
New Brunswick, NJ 08901

Dear Mr. Russell:

As requested in your letter of April 1, 1971 to Mr. Robert C. Merritt, x-ray diffraction and microscopic analyses have been completed on the two Vermont final product samples. In your letter you stated Sample A (CSMRI No. 15) was produced using the delaminator and that Sample B (CSMRI No. 16) was produced without using the delaminator.

SUMMARY AND CONCLUSIONS

X-ray diffraction and microscopic studies showed the samples differ in some respects. X-ray diffraction studies indicated a trace of tremolite-actinolite in CSMRI Sample 16; no tremolite-actinolite was noted in the x-ray diffractogram of CSMRI Sample 15.

Microscopic studies of the two samples indicated:

1. Sample 16 (undelaminated) was slightly finer grained than Sample 15, possibly due to preferential liberation during the delamination process followed by preferential flotation of large talc plates.
2. Both samples contained some needle-like particles whose refractive indices were above the refractive index of the 1.600 oil used. These particles were tentatively identified as tremolite-actinolite. Sample 16 (undelaminated) contained a noticeably larger amount of these particles than did Sample 15 (delaminated). Again, this effect is possibly due to preferential floatability of large talc plates as opposed to reground tremolite-actinolite needles.
3. The platy content of Sample 15 (delaminated) was slightly higher than the platy content of Sample 16 (undelaminated).

4. The fibrous content of Sample 16 (undelaminated) was slightly higher than the fibrous content of Sample 15 (delaminated).
5. Overall, Sample 16 (undelaminated) looked as if it had been ground more than Sample 15 (delaminated).

RESULTS AND DISCUSSION

The results of the x-ray diffraction study are shown in Figure 1. As may be noted from the tracings of the diffractograms, the mineralogical composition of both samples is essentially the same. The only difference noted was the trace amount of tremolite-actinolite in Sample 15 (delaminated).

Microscopic analyses of the as-received samples yielded the following results (all values are visual estimates):

CSMRI Sample No.	Platy %	Foliated %	Fibrous %	F.G.A. %	CO ₃ %	Dark Opaque %	Tremolite- Actinolite %	mm			
								>0.1	0.1-0.05	0.05-0.01	<0.01
15	95	3	2	<1	tr	<1	tr	<1	50	40	10
16	92	3	4	<1	tr	<1	1	<1	40	40	20

Photomicrographs of these two samples are shown in Figure 2.

The microscopic study indicated Sample 16 (undelaminated) was slightly finer grind than Sample 15, contained a slightly smaller percentage of platy material than Sample 15, and contained a slightly larger amount of fibrous material than did Sample 15. Some needle-like particles were noted in both samples; Sample 16 contained a noticeably larger amount of these needles. These needle-like particles had refractive indices above that of the refractive index of the immersion oil used (1.600). They were tentatively identified as tremolite-actinolite. The x-ray diffraction study tended to substantiate this identification.

Mr. Robert Russell

Page 3

April 14, 1971

Two anomalies are notable among the foregoing results. These anomalies are:

1. The production of a relatively coarse-grained product from feed that has been processed through the delaminator - a process that is known to result in some size reduction.
2. The appearance of a significantly larger amount of liberated tremolite-actinolite in the undelaminated product.

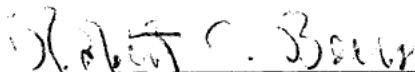
Several explanations are possible for the first anomaly.

- a. The possibility that the delaminator is producing a relatively large quantity of thin talc plates from a relatively few talc books. These books of plates would have appeared as single plates before delamination.
- b. The inherent higher floatability of large plates as opposed to fines.

The second anomaly can also be explained by the inherent floatability of large plates and fibers as opposed to fines. Preliminary (unreported) studies of unbeneficiated ore taken before and after the delaminator indicate that the delaminator significantly grinds fibers to very small size.

Should you have any further questions regarding these samples, please feel free to contact us.

Sincerely,



Robert C. Beers
Project Engineer
Metallurgical Division

AND

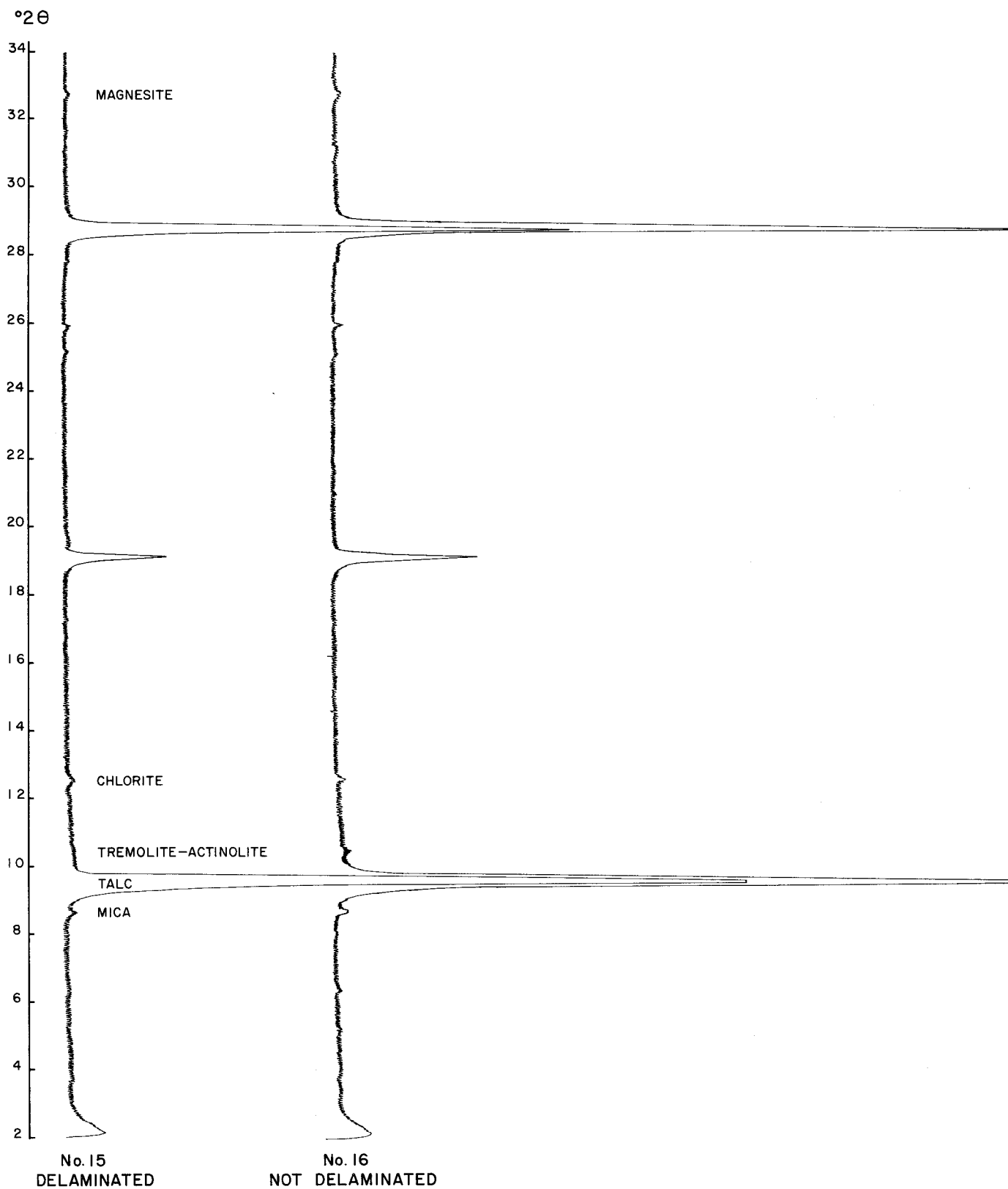


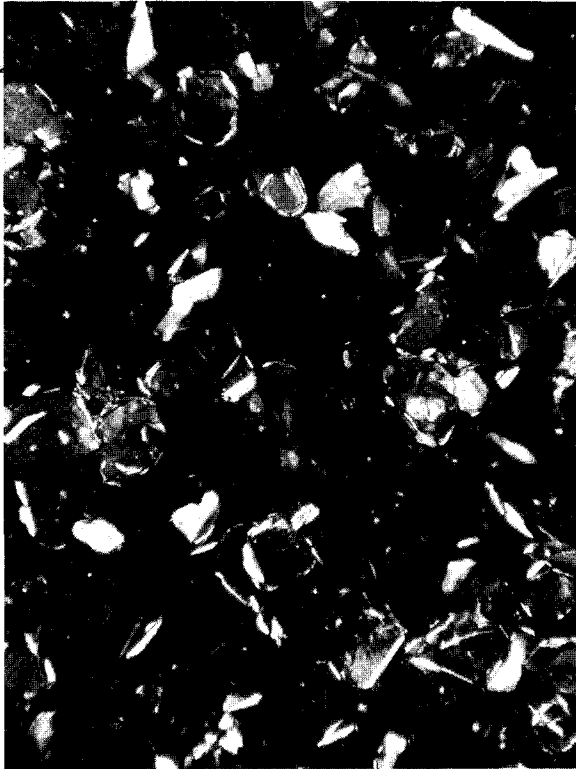
M. G. Pattengill
Project Engineer
Mining Division

/arh
encs

FIGURE I

X-RAY DIFFRACTOGRAMS OF TWO SAMPLES OF VERMONT TALC
(Cu RADIATION, Ni FILTER, 2°/MIN., SCALE FACTOR 1×10^4)





Sample 15, produced using the delaminator.



Sample 16, produced not using the delaminator.

Scale
0.1 mm

Figure 2. Photomicrographs of two Vermont talc samples.

Exhibit 49



Dr. A. J. Goudie
Johnson and Johnson
Research Center
501 George Street
New Brunswick, New Jersey 08901

EXAMINATION
OF
JOHNSON AND JOHNSON'S BABY POWDER

Date: 27 October 1972

MA Number: 2546

Copy 1 of 4

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walter c. mc crone associates, inc.
2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616

EXAMINATION OF JOHNSON AND JOHNSON'S BABY POWDER

Summary

Two samples of Johnson and Johnson's Baby Powder, batch number 108T and 109T, which correspond to the samples examined by Professor Seymour Z. Lewin of New York University on behalf of the FDA have been examined by x-ray diffraction, light microscopy, transmission electron microscopy and electron diffraction to determine whether they contain any asbestiform minerals.

Both samples contained an insignificant amount of tremolite ($\leq 0.5\%$). Neither sample contained chrysotile.

Introduction

On behalf of the FDA, Professor Seymour Z. Lewin of New York University is examining a number of commercial talcum powders for the presence of asbestiform minerals. Two of the samples which he has examined are samples of Johnson and Johnson's Baby Powder, batch number 108T and batch number 109T. Johnson and Johnson therefore requested Walter C. McCrone Associates to examine samples from the same batches to determine whether they contained any asbestiform minerals.

Materials and Method of Conducting Tests

Two samples were submitted, identified as Johnson and Johnson's Baby Powder, batch numbers 108T and 109T.

For x-ray diffraction examination, the samples were examined on a Phillips-Norelco verticle diffractometer using $\text{CuK}\alpha$ radiation and a scanning speed of 1° per minute. The dispersion staining technique was used for the light microscopical examination and the electron microscopy-electron diffraction examination was carried out using procedures previously described (MA report 2330-1; dated 10 August 1971).

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Results

X-ray Diffraction

The diffractograms were carefully examined in the vicinity of the major peaks of chrysotile and tremolite. Neither mineral was present. The presence of peaks in the vicinity of $12.0-12.5^\circ 2\theta$, the region in which one of the principal lines of chrysotile may be found, was correlated with peaks in the vicinity of $6^\circ 2\theta$ and are thus attributable to chlorites. No significant peaks were observed in the 24° region which would be required were chrysotile present.

Light Microscopy

Using the dispersion staining technique and a liquid of refractive index 1.550, the samples were examined for chrysotile particles and fibers, but none could be found. Using a similar technique with a liquid of refractive index 1.605, the samples were similarly examined for the presence of tremolite and a few individual crystals were found, some rod shaped. The total tremolite content of the two samples would be approximately 0.5% for 108T and about 0.2-0.3% for 109T.

Electron Microscopy and Electron Diffraction

Several electron microscope grids from both samples were examined in their entirety and although some fibers were observed these were shown by electron diffraction to be shards of talc or rolled talc. No chrysotile fibers were found.

Conclusion

A detailed examination of two samples of Johnson and Johnson's Baby Powder, batch numbers 108T and 109T has shown this material to be substantially free of asbestiform minerals. A few tremolite rods were observed in both samples at a level less than 0.5%. No chrysotile has been detected.

Respectfully submitted,

Ian M. Stewart

Ian M. Stewart
Manager, Electron Optics Group

-2- walter c. mccrone associates, inc.

Exhibit 50

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE

P.O. Box 112

GOLDEN, COLORADO 80401

TO W. H. Ashton DATE February 26, 1973

FROM W. P. Reid and W. T. Caneer PROJECT NO. C10704

SUBJECT Mineralogical Examination of Five Talc Samples

In compliance with your request, mineralogical studies were made on the following talc samples:

30-71-S
 30-B-71-S
 30-C-71-S
 32-71-S
 34-71-S

The purpose of these studies was to determine the mineralogy of these samples with an emphasis on the occurrence of any asbestos type minerals. X-ray Diffraction and microscopic studies were made on as-received samples, heavy liquid separates, and on acid leached residues.

SUMMARY

The following table shows the nature and relative abundance of minerals in each sample.

<u>Sample</u>	<u>Mineralogy</u>
30-71-S	Major (>40%) talc [$\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$] Moderate (20-40%) magnesite (MgCO_3) Trace (<1%) chlorite Trace calcite (CaCO_3) and dolomite [$\text{CaMg}(\text{CO}_3)_2$] Trace opaques (Fe oxides, etc.) Slight trace (<0.1%) tremolite-actinolite (Ca-Mg-Si-O-OH)
30-B-71-S	Major talc Moderate magnesite Trace dolomite and calcite Trace opaques Slight trace chlorite Slight trace tremolite-actinolite

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE

P.O. Box 112

GOLDEN, COLORADO 80401

TO W.H. Ashton

FROM W.P. Reid and W.T. Caneer

SUBJECT Mineralogical Examination of Five Talc Samples
Page 2

DATE February 26, 1973

PROJECT NO. C10704

<u>Sample</u>	<u>Mineralogy</u>
30-C-71-S	Major talc Minor (5-20% magnesite Very minor (1-5% chlorite) Trace calcite and dolomite Slight trace opaques
32-71-S	Major talc Moderate magnesite Very minor chlorite and possible serpentine $[\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4]$ Trace calcite and dolomite Very minor opaques Slight trace anthophyllite (?) $[(\text{Mg}_1\text{Fe})_7(\text{Si}_8\text{O}_{22}(\text{OH})_3]$
34-71-S	Major talc Minor magnesite Very minor chlorite Very minor dolomite Trace mica $[\text{K-Al-Si-O-OH}]$ Trace opaques

Relative to possible asbestos type minerals the above table shows that Samples 30-71-S and 30-B-71-S contain slight traces of tremolite-actinolite minerals. Sample 32-71-S is suspected to contain a very minor amount of serpentine which may be chrysotile. In addition a slight trace of possible anthophyllite was observed in this sample. It is recommended that more studies be made on greater quantities of Sample 32-71-S to confirm the presence of these minerals.

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE

P.O. Box 112

GOLDEN, COLORADO 80401

TO W.H. Ashton

FROM W.P. Reid and W.T. Caneer

SUBJECT Mineralogical Examination of Five Talc Samples
Page 3

DATE February 26, 1973

PROJECT NO. C10704

RESULTS AND DISCUSSION

Each sample of ground talc ore was separated into the following fractions by centrifuging in heavy liquids: specific gravity less than 2.90; specific gravity greater than 2.90. After making an X-ray diffractogram of the greater than 2.90 specific gravity fractions, the sample was leached with 1:1 HCl to remove magnesite. The insoluble residue was then examined for amphiboles under the petrographic microscope. The weight percent in the various fractions as well as the mineralogy of each fraction is shown in the following table.

<u>Sample</u>	<u>Weight, %</u>	<u>Mineralogy</u>
30-71-S	100.0	
Specific gravity < 2.90	74.5	Major (>40%) talc Very minor (1-5%) dolomite Trace (<1%) chlorite Trace calcite and magnesite
Specific gravity > 2.90	25.5	Major magnesite Very minor talc Trace dolomite and calcite
HCl leach residue	0.4	Major opaques (magnetite, etc.) Major talc Slight trace (<0.1%) tremolite-actinolite
30-B-71-S	100.0	
Specific gravity < 2.90	76.4	Major talc Minor (5-20%) magnesite Trace dolomite Slight trace chlorite

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P.O. Box 112

GOLDEN, COLORADO 80401

TO W. H. Ashton DATE February 26, 1973

FROM W. P. Reid and W. T. Caneer PROJECT NO. C10704

SUBJECT Mineralogical Examination of Five Talc Samples
Page 4

Sample	Weight, %	Mineralogy
30-B-71-S (cont'd)		
Specific gravity >2.90	23.6	Major magnesite Very minor talc Trace calcite
HCl leach residue	0.4	Major talc Major opaques (magnetite, sulfide, etc.) Slight trace tremolite-actinolite
30-C-71-S	100.0	
Specific gravity <2.90	90.5	Major talc Minor magnesite Very minor chlorite Trace dolomite
Specific gravity >2.90	9.5	Major magnesite Minor talc and dolomite Trace calcite
HCl leach residue	<0.1	Major opaque Minor talc
32-71-S	100.0	
Specific gravity <2.90	58.4	Major talc Very minor magnesite Very minor chlorite and serpentine (?) Trace calcite
Specific gravity >2.90	41.6	Major magnesite Very minor talc Trace dolomite Slight trace calcite

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE

P.O. Box 112

GOLDEN, COLORADO 80401

TO W. H. Ashton DATE February 26, 1973

FROM W. P. Reid and W. T. Caneer PROJECT NO. C10704

SUBJECT Mineralogical Examination of Five Talc Samples
Page 5

Sample	Weight, %	Mineralogy
32-71-S (cont'd) HCl leach residue	2.5	Major talc Minor opaques Slight trace anthophyllite (?)
34-71-S	100.0	
Specific gravity <2.90	80.9	Major talc Very minor magnesite Very minor chlorite
Specific gravity >2.90	19.1	Major magnesite Minor dolomite Trace mica
HCl leach residue	0.4	Major opaques Minor talc

In an attempt to verify the presence of serpentine in Sample 32-71-S X-ray diffraction step scans were made over the critical diffraction peaks of serpentine. Figure 1 shows the results of the step scanning. Since both chlorite and serpentine have diffraction peaks in the 7\AA region, it is possible to confuse these minerals based only on a 7\AA peak. However, a corresponding peak in the 14\AA region verifies the presence of chlorite. Curve 1 (Figure 1) represents a step scan across the 7\AA region for the as-received Sample 32-71-S. As may be seen two peaks occur at 7.1\AA and 7.3\AA . In order to determine if these peaks represent chlorite or possibly serpentine, step scans were made across the 14\AA region. If this 7.1\AA and 7.3\AA peaks represent chlorite, then there should be corresponding peaks at 14.2\AA and 14.6\AA . Curve 1A is a step scan across the 14\AA region. At 14.2\AA peak occurs which corresponds to the 7.1\AA peak. These 2 peaks represent chlorite. However, no 14.6\AA peak is present which suggests that the 7.3\AA represents serpentine-not chlorite.

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE

P.O. Box 112

GOLDEN, COLORADO 80401

TO W. H. Ashton DATE February 26, 1973

FROM W. P. Reid and W. T. Caneer PROJECT NO. C10704

SUBJECT Mineralogical Examination of Five Talc Samples
Page 6

Since chlorite has a specific gravity greater than 2.65 and serpentine has a specific gravity less than 2.65, step scans were made on the fraction of Sample 32-71-S which has a specific gravity less than 2.65. The less than 2.65 specific gravity fraction was 0.4 weight percent of the total sample. If serpentine is present the 7.3Å peak should be enhanced and the 7.1Å chlorite peak should be diminished. Curve 2 represents a step scan across the 7Å region of the fraction with a specific gravity less than 2.65. As may be seen the 7.3Å peak is enhanced and the 7.1Å peak is diminished relative to the as-received sample. Curve 2A (step scan across the 14Å region) shows no 14.6Å peak.

Based on the above step scanning data there is good reason to suspect that serpentine is present in Sample 32-71-S. It is possible that other minerals such as kaolinite or a very iron rich chlorite could give similar data. However, based on the geological and chemical factors associated with this sample, it is more probable that chlorite present will be magnesium-rich rather than iron rich and that serpentine is a more likely occurrence than kaolinite.

Microscopic examination of the fraction with a specific gravity less than 2.65 revealed very minor (1%) amounts of possible serpentine fibers. Identification of the serpentine was facilitated by staining with 1% iodine in glycerine.

It is recommended that further work be done on this sample.

Exhibit 51

Johnson-Johnson

NEW BRUNSWICK, N. J.

June 6, 1973

Dr. F. D. Pooley
Department of Mineral Exploitation
University College
Newport Road
Cardiff, Wales
CF2 1TA
GREAT BRITAIN

Dear Fred,

Following the request of Tom Shelley, I will be sending you shortly, 26 ten-gram split production samples of Vermont Talc to be put through the British Toilet Preparations Federation density concentration technique. After I receive the proposed procedure for this density concentration technique from Bob Dean, I will have the same samples put through this procedure by us. Also, in the same shipment will be 3 three-hundred gram samples of production Vermont Talc for your study to remove tremolite.

Best regards.

Sincerely yours,

F. Robert Rolle
F. Robert Rolle

ab

cc: Mr. W. H. Ashton
Dr. M. H. Goodman
Dr. A. J. Goudie
Dr. W. Nashed
Dr. D. R. Petterson
Dr. T. H. Shelley

RECEIVED

JUN 6 1973

W. NASHED
JOHNSON & JOHNSON

AIR
MAIL

Exhibit 52



walter c. m^ccrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

11 February 1974

Dr. F. R. Rolle
Johnson and Johnson
Research Center
501 George Street
New Brunswick, New Jersey 08901

Dear Dr. Rolle:

We have completed the analyses of your samples S5-888, T-280 and S1-1028-72831, as per your request.

We found chrysotile only in sample S5-888, T-280 and tremolite in neither of the samples. As a rough estimate, good to about an order of magnitude, I would place the amount of chrysotile present at $\leq .0005\%$.

Representative photomicrographs are included with this report. Thank you for consulting McCrone Associates. If you have any questions concerning any aspect of this work, please feel free to call.

Yours sincerely,

Richard Shimps
Electron Microscopist

RS:fe
Enclosures
Ref: 2546

Exhibit 53



walter c. mcrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

10 April 1974

Mr. R. S. Russell
Johnson and Johnson
501 George Street
New Brunswick, New Jersey 08901

Dear Mr. Russell:

Using the transmission electron microscope we have examined four (4) samples of talc designated as A, UDSA, UDSB and AC.

Sample AC contained one small fiber of chrysotile about $1\ \mu\text{m}$ in length. There was also some organic film which bubbled and decomposed in the electron beam. This film apparently is soluble in the isopropyl alcohol used to disperse the samples and on drying forms a thin film covering the specimen grid. Most of the sample was clean with not much rolled talc or talc shards.

Sample UDSB also contained one fiber of chrysotile. Again this fiber was small, in the size range of $1\ \mu\text{m}$. There were some talc shards in this sample but most of it was flaky quality talc.

Sample UDSA was mostly platy talc with no fibers and no talc shards.

Sample A contained a high amount of talc shards and fibrous or ribbon-like talc. I would estimate the percentage of this fibrous ribbon-like talc and talc shards as 1-5%. The plates were small and there was also an organic film present. Electron micrographs and diffraction patterns are included with this report. If there are any questions on this report or the data contained herein, please feel free to contact me.

Very truly yours,

Gene R. Grieger
Gene R. Grieger
Research Physicist

GRG:fe
Enclosures
Ref: 2546

Exhibit 54

ATTACHMENT 6



Mr. Vernon Zeitz
Windsor Minerals Company
Windsor, Vermont 05089

EXAMINATION OF TALC SAMPLES

ARGONAUT ORE BODY

Date: 24 April 1974

MA Number: 3295

Copy \ of 7

walter c. mccrone associates, inc.
2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616

Examination of Talc Samples

Argonaut Ore Body

SUMMARY

An intensive examination has been made by x-ray diffraction and electron microscopy of 38 core samples taken from a new ore body which Windsor Minerals, Inc. are contemplating exploiting. The examination was undertaken to determine the mineralogical content of the core samples and, in particular, whether or not there was any significant content of asbestiform minerals in the ore body. For comparison, three core samples from the current ore body were also examined.

The majority of the samples showed no evidence of any asbestiform minerals present and, of the 15 samples that did show an asbestiform mineral, only one exceeded an estimated level of approximately 0.0005%. It is anticipated that beneficiation of the ore would significantly reduce these low levels and that, therefore, the beneficiated ore would prove to be free of any asbestiform mineral. It is concluded that the ore body is of suitable quality for the manufacture of high grade cosmetic and toiletry products.

INTRODUCTION

In connection with the assessment of a new talc ore body which Windsor Minerals, Inc. are developing, they requested the assistance of Walter C. McCrone Associates in determining whether or not the ore body would prove to be contaminated by asbestiform minerals which might prove to be a potential health hazard. An intensive investigation of 38 core samples taken from the ore body and three samples taken from their currently used ore was therefore carried out using the techniques of x-ray diffraction and transmission electron microscopy combined with electron diffraction.

This report records the results of this examination.

MATERIALS AND METHOD OF CONDUCTING TESTS

Forty-one samples were received from Windsor Minerals, Inc. These were identified as ore body core samples and bore a number which corresponded to their location in the ore bodies.

A portion of each sample was prepared for x-ray diffraction and was examined in a Philips vertical diffractometer using $\text{CuK}\alpha$ radiation at a scanning speed of 1° per minute.

Another portion from the sample was prepared for electron microscopy by suspending in isopropyl alcohol and transferring these suspensions to an electron microscope support grid which had previously been coated with a carbon support film. The resulting preparation was examined in the JEM 200 transmission electron microscope using an accelerating voltage of 150 kV. The sample was scanned at a magnification of approximately 25,000X and electron diffraction was carried out on those fibers which were suspect, that is, those fibers which were not readily identifiable as rolled talc or talc splinters and shards. Representative electron micrographs were taken of all samples and also of suspect fibers.

RESULTS

The results of the x-ray diffraction examination and of the electron microscopical examination are summarized in Tables 1 and 2.

X-Ray Diffraction Examination

The principal contaminant minerals found in the core samples are magnesite, chlorites and quartz. The magnesite level is generally high, ranging between about 20% to over 60% although it is difficult to accurately estimate the magnesite content due to preferred orientation effects in some cases enhancing the talc signal. In one sample, however, sample 6-R-72, 179-184, the magnesite content was very low, of the order of 2-3%. In ten of the samples a shorter diffractometer trace was used which did not allow quantitation of the magnesite content.

No attempt has been made to identify which chlorites are present in these samples: the chlorite group of minerals is comprised of some twenty to thirty minerals which are closely related in their interatomic spacings and their specific identification is not relevant to the present problem.

In no instance was any asbestos or potentially asbestiform mineral identified by x-ray diffraction, the limit of whose sensitivity is approximately $\frac{1}{2}$ to 1% for the amphibole minerals and probably slightly higher than this for chrysotile asbestos..

Electron Microscopical Examination

All the samples were examined extensively in the electron microscope concentrating attention on the fibrous components of the samples. In general, all the samples showed a very good, clean, platy talc such as illustrated typically by plates 3538 and 3545 accompanying this report. There were, of course, as in all talc samples, some apparently fibrous components and, in most instances, these are pieces of rolled talc or talc

shards and fronds, resulting from splitting of the talc plates. As the feature of particular interest was the asbestiform minerals which might be present in the material, our attention was focused on these and thus the photographic documentation accompanying this report consists almost exclusively of representations of this small fibrous fraction. As will be seen from Table 2, only two samples (2R-72, 232-257 and 53-4-68, 512½-576) showed a level of asbestos above 0.0005%, the actual figures being 0.007% and 0.001%, respectively, for chrysotile asbestos plus approximately 0.0001% of fibrous tremolite. Excluding these samples, the remaining samples which showed asbestiform fibers are exhibiting levels which are no higher than has been seen in a raw composite used to manufacture a finished product. The levels of chrysotile observed in the two high samples is only an order of magnitude above this and would presumably be reduced considerably by your beneficiating process.

CONCLUSIONS

The examination of 41 core samples, 38 of them from a new talc ore body, using the techniques of x-ray diffraction, electron microscopy and selected area electron diffraction have shown that, even prior to beneficiation, this material is of extremely high grade, substantially asbestos free, and of a quality which we associate with cosmetic grade talc. In only two samples was a level of chrysotile observed which was higher than 0.0005%. Chrysotile levels of this order of magnitude might well arise during the taking and handling of the samples.

Table 1

X-ray Diffraction Analysis of Talc Ore Core Samples

Sample DDH	Description Designation	Quartz	Carbonate	Chlorites	Asbestiform Minerals
1-R-72	87 - 155	n.d.	40-50	~3%	n.d.
	155 - 164	n.d.	60-65	2-3%	n.d.
	164 - 176	n.d.	35-40	5-8%	n.d.
	184 - 241	n.d.	30-35	~5%	n.d.
2-R-72	131 - 167	n.d.	35-45	3-5%	n.d.
	183 - 232	n.d.	30-40	3-5%	n.d.
	232 - 257	n.d.	50-60	~3%	n.d.
	257 - 268	n.d.	30-40	3-4%	n.d.
3-R-72	51 - 62	n.d.	n.a.	10-15%	n.d.
	158.5 - 170	n.d.	n.a.	3-5%	n.d.
	174.5 - 190	n.d.	50-60	5-8%	n.d.
	229 - 240	n.d.	45-55	10-15%	n.d.
6-R-72	92 - 111	n.d.	20-30	2-3%	n.d.
	112 - 133	trace	40-50	3-4%	n.d.
	147 - 165	n.d.	30-35	~2%	n.d.
	166 - 176	?	25-35	8-10%	n.d.
	179 - 184	n.d.	2-3	10-15%	? chrysotile
8-R-72	49 - 89	n.d.	n.a.	3-5%	n.d.
	98 - 115	n.d.	n.a.	2-3%	n.d.
	136.5 - 141	n.d.	n.a.	3-5%	n.d.
	160.5 - 192	n.d.	20-30	3-5%	n.d.
	207 - 212	n.d.	n.a.	2-4%	n.d.
9-R-72	38 - 92	n.d.	40-50	3-5%	n.d.
	93 - 103	n.d.	30-35	1-2%	n.d.
	205 - 260	n.d.	40-50	3-4%	n.d.
	267 - 275	n.d.	30-40	1-2%	n.d.
11-R-72	152.5 - 169	n.d.	n.a.	5-8%	n.d.
	177 - 193	n.d.	n.a.	3-5%	n.d.
	196 - 219	n.d.	n.a.	5-8%	n.d.
	224 - 236	n.d.	n.a.	5-8%	n.d.
18-R-73	183 - 214	n.d.	30-35	~3%	n.d.
	277 - 297	n.d.	50	2-3%	n.d.
	297 - 304	n.d.	40-50	~5%	n.d.
19-R-73	208 - 237	n.d.	30-35	~3%	n.d.
	237 - 248	n.d.	30-40	2-3%	n.d.
	248 - 257	n.d.	20-30	2-3%	n.d.
	257 - 277	n.d.	20-30	2-3%	n.d.
	278 - 294	n.d.	50-60	2-3%	n.d.
10-H-67	{366 - 370} {374 - 402}	n.d.	30-40	1-3%	n.d.
36-H-67	399 - 466	n.d.	50-60	8-10%	n.d.
53-II-68	512.5 - 576	trace ??	10-20	5-8%	n.d.

*n.a. = not analyzed

n.d. = not detected

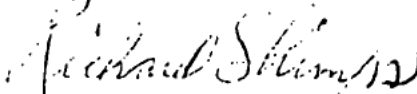
Table 2

Electron Microscopic Analyses of Talc Ore Core Samples

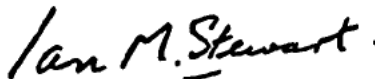
Sample DDH	Description Designation	Chrysotile	Amphibole
1-R-72	87 - 155	n.d.	n.d.
	155 - 164	n.d.	n.d.
	164 - 176	0.0002%	n.d.
	184 - 241	n.d.	n.d.
2-R-72	131 - 167	0.0001%	n.d.
	183 - 232	0.0001%	n.d.
	232 - 257	0.007%	0.0001%
	257 - 268	0.0001%	n.d.
3-R-72	51 - 62	n.d.	n.d.
	158.5- 170	n.d.	n.d.
	174.5- 190	n.d.	n.d.
	229 - 240	n.d.	n.d.
6-R-72	92 - 111	0.0003%	n.d.
	112 - 133	0.0001%	0.0001%
	147 - 165	n.d.	n.d.
	166 - 176	0.0002	n.d.
	179 - 184	0.0004%	0.0001%
8-R-72	49 - 89	n.d.	n.d.
	98 - 115	n.d.	n.d.
	136.5- 141	n.d.	n.d.
	160.5- 192	n.d.	n.d.
	207 - 212	n.d.	n.d.
9-R-72	38 - 92	0.0002%	n.d.
	93 - 103	n.d.	n.d.
	205 - 260	0.0005%	n.d.
	267 - 275	0.0001%	n.d.
11-R-72	152.5- 169	n.d.	n.d.
	177 - 193	n.d.	n.d.
	196 - 219	n.d.	n.d.
	224 - 236	n.d.	n.d.
18-R-73	183 - 214	n.d.	n.d.
	277 - 297	n.d.	n.d.
	297 - 304	n.d.	n.d.
19-R-73	208 - 237	n.d.	n.d.
	237 - 248	0.0003%	n.d.
	248 - 257	n.d.	n.d.
	257 - 277	n.d.	n.d.
	278 - 294	0.0004%	n.d.
10-H-67	{366 - 370}	n.d.	n.d.
	{374 - 402}		
30-H-67	399 - 466	n.d.	n.d.
53-H-68	512.5- 576	0.001%	0.0001%

It is our conclusion, based on the platyness of the material and its freedom from asbestiform minerals, that the ore body would be suitable for use in high quality cosmetic and toiletry products.

Respectfully submitted,



Richard Shimps
Research Chemist



Ian M. Stewart
Manager, Electron Optics Group

RS:IMS:smg

walter c. mc crone associates, inc.

Exhibit 55

B1228-04
Scanned

Microscopic Examination of Johnson's Baby Powder

For amphibole (tremolite-actinolite)

<u>Lot Numbers:</u>	285S	10/11/72
	307R	11/2/72
	068Z	3/9/73
	086Z	3/26/73

Petrographic optical microscopy revealed "trace" amounts of amphibole in each of the above samples.

Base on the numbers of particles scanned, we estimate "trace" amounts to be .001 to .01% by weight.

Description of Particles:

Shape: Prismatic, columnar, parallel-sided rods.

Size: From 20 x 4 microns to 200 x 30 microns.

Identity: The optical properties of the particles are closer to actinolite than tremolite.

Remarks: In several of the larger particles, the amphibole was observed to be intrinsically attached to a talc particle.